THE NAVY'S AUTOMATED COMMAND MANAGEMENT INFORMATION SYSTEM.

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BY

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A Thesis Submitted to the School of Government and Business Administration of The George Washington University in Partial Fulfillment of the Requirements for the Degree of Master of Business Administration

April 30, 1971

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CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

Since the introduction of electric accounting machine (EAM) equipment, computing hardware[1] has become increasingly complex. The internal speed of computers has progressed from the milisecond range, through the microsecond area, and into nanosecond timeframes. Input/output devices have increased from 150 cards per minute input and 200 lines of print per minute output to speeds of 2,000 cards and 3,000 lines respectively.

The high speeds of the equipment were contrasted by the tediously slow pace with which programmers were able to write instructions for the computer. In an effort to approach a reasonable level of computer utility software techniques were developed. These accelerated the production and implementation of functional applications. The highest level programming language currently used, however, is the

[1]Throughout this paper the computing equipment and peripheral devices will be referred to as "hardware." The program instructions and the related documentation including flow charts, source programs, object programs and test data which are necessary to cause a computer to react will be referred to as "software."

compiler which facilitates program generation and the manipulation of a predetermined array of data. Each array or file must be defined, retrieved, and displayed in accordance with a previously written program and each application addressing that file must follow the same rigid format.

As a result of the information revolution which has evolved in recent years, it has become apparent that the technological tools must be improved. Managers with a minimum of ADP knowledge must be able to extract pertinent information from their data bases without the usual lead time involved in program development. Software enhancements known as data management systems (DMS) are now being generated by major software companies under their own trade names.

This thesis will explore the theory of a DMS and investigate the feasibility of employment of such a system in conjunction with the U. S. Navy's Chief of Naval Operations Command/Management Information System (CNOCOM/MIS).

SCOPE OF THE INVESTIGATION

The study will attempt to analyze the CNOCOM/MIS, which is currently being produced, to determine the data base structure, the intended users, the maintenance requirements, and the operational environment in which the system will function.

In order to illustrate the need for a DMS, such areas as data accessibility, file manipulation and display requirements will be developed through a description of the total system. The description and subsequent amplification will indicate reasons for modular design as well as the utility of combining transitional and apocalyptic approaches in data base construction.

RESEARCH/ANALYSIS METHODS

The nature of the thesis necessitates the extensive utilization of primary source material. Reference documents will consist of Department of Defense and Department of the Navy directives, complemented by surveys, proposals and reports generated by the latter department. Studies accomplished by civilian contractors regarding CNOCOM/MIS will also be used. Personal interviews will relate the current stages in development of CNOCOM/MIS, the deviations brought about by certain events during development and the attitudes of the designers, analysts and programmers about their product. In addition, software/hardware consultants will be queried regarding their executive system and DMS packages. Technical information to provide guidance and evaluative techniques for the overall process of management information system (MIS) development will be gained from books and periodicals.

Analysis will be primarily deductive, CNOCOM/MIS requirements will be pitted against the contrasting capabilities of DMS techniques and existing software in order to determine the system best suited for fulfilling the desired objectives.

ORGANIZATION OF THE STUDY

Chapter II relates the U. S. Navy's response to the information explosion brought about by computer technology. It indicates the evolution of computer utility from World War II to the present. Toward the end of this era, it describes the efforts put forth by top-level management to achieve coordination of systems culminated by the Chief of Naval Operations (CNO) in CNOCOM/MIS.

Chapter III begins a description of CNOCOM/MIS by explaining the non-functional subsystems and their necessity and relationship in the system. These subsystems are the basic driving forces for the total environment and the means through which all tasks of CNOCOM/MIS are accomplished.

The chapter concludes with a definition of the data base, its design, construction method, and maintenance techniques.

A description of the six functional CNOCOM/MIS subsystems opens Chapter IV. These are the principles and rules which will cause the operational applications to be

accomplished. They are all dependent upon the non-functional subsystems and to a large degree dependent upon their own interfacing to fully realize their objectives.

This chapter analyzes certain key facets of the system in order to show the need for a DMS. It briefly describes the system from the user's standpoint and the data sponsor's position.

The fifth chapter summarizes facts pertinent to the basic thesis question in order to build a conclusion by deductive reasoning. The third generation (U-1108) hardware system will be briefly discussed followed by long range plans and/or ideas for CNOCOM/MIS of the future.

The final section of Chapter V summarizes the conclusions with respect to the feasibility of using a DMS in conjunction with CNOCOM/MIS in order to enhance data accessibility, processing and report generation by the non-technical data processing layman.

CHAPTER II

WHO NEEDS AN AUTOMATED MIS?

THE INFORMATION EXPLOSION

During World War II, the Navy assisted in the development of electronic computers for scientific and engineering purposes. The early computers were used for high-speed formula evaluation. The follow-on of these computers provided capability for business and logistics work. These computers were constrained severely due to a lack of adequate program storage devices. In addition, the software did not provide full range capabilities to which the industry is currently accustomed.

The Navy's automated systems development has followed an unfortunate pattern of establishing new ADP installations as additional applications evolved. This approach seemed satisfactory in the early phase when the equipment had limited capability and slight, if any, means of rapid data transmission. Each system satisfied a need, but in most cases the acquisition of the system was based on the strength of the justification which could be presented by the organizational segment which had the particular job to do.

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There was little thought given to future integrated systems as each implementer devised his own standards.

Most of the information systems in the past, and some of those still being designed, are concerned with the achievement of more economic methods of collecting, transporting, processing, and displaying information. This is not necessarily the same as the organization and the presentation of pertinent facts concerning alternative choices available to the manager for decision-making.

A wider, more imaginative use is now being developed, extending into middle-management and providing "as requested" reports on a demand basis. The same data formerly used only for routine transactions and scheduled reports can now be selected and transformed for management control purposes. Third generation computers have moved information systems into a new phase. Computers using hugh data banks, now have the capability of satisfying multiple users with diverse applications. Navy management has become increasingly aware of the new benefits to be derived from the computer and more areas have been identified where the computer can provide greater economies through the consolidation of redundant data files and ADP equipment across functional or application lines.

ERA OF PLANNING AND COORDINATION

In 1966, the need for control of ADP and information systems became evident in order to realize fully the advantages afforded by computer systems. A Presidential memorandum of 28 June, 1966, directed all government agencies to give thorough study to new ways in which the computer might be used. The Secretary of Defense further amplified this message by proclaiming that such systems should be fully responsive to management's total requirements and directed the standardization of data systems.

A study conducted in 1966, at the direction of the Chief of Naval Operations (CNO), found a diffusion of ADP responsibilities within OPNAV. The study group recommended as organizational change. The recommendation called for a strong, centralized organization to plan and direct Navy information and data systems. On 28 April, 1967, the CNO established the Navy Information Systems Branch; and in January , 1968 formed the Information Systems Division (OP-91) within the Navy Program Planning Office. At this same time Captain R. A. Jones (OP-912), Project Officer, headed a study group to consider the needs of the Navy for information system support.

The efforts resulted in a proposed concept for a Navy Integrated Command/Management Information System (NAICOM/MIS)[1] which would meet the needs. The concept, which was approved in September, 1968, also recognized the need for a CNO Command/Management Information System (CNOCOM/MIS). This system would support the needs of the CNO and the Naval Operations (OPNAV) staff, and would serve as the capstone of the NAICOM/MIS, and function as the information system in support of the Navy Headquarters subsystem of the Worldwide Military Command and Control System (WWMCCS).[2] An implementation plan[3] for CNOCOM/MIS was approved and promulgated in early 1969. The objectives of the new system were stated as follows:

a. To improve the quality and credibility of information at the OPNAV level.
b. To improve the timeliness of information to the Chief of Naval Operations.
c. To preclude the duplication of information requirements placed on subordinates.
d. To fully utilize the capabilities of the computer to meet requirements.
e. To provide access to collected and available information by all authorized OPNAV

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[1]U. S. Department of the Navy, <u>Report of the Navy Study Group for Navy Integrated Command/Management Information System - I (NAICOM/MIS-I)</u>, July, 1968.

[2]Planning Research Corporation, "Chief of Naval Operations Command/Management Study Report," PRC R-1388, Vol. I, January, 1970.

[3]U. S. Department of the Navy, OPNAV INST 5200.9 <u>Chief of Naval Operations Command/Management Information System</u>, February 9, 1969.

users while insuring adequate measures to preclude unauthorized disclosure of classified information, including "need to know" safeguards.

f. To be responsive to the information requirements of higher authority. Specifically to provide requested operational information to WWMCCS and business and logistics information as required to the Secretary of the Navy (SECNAV) through the Department of the Navy Management Information and Control System (DONMICS).[1]

EMPHASIS ON INTEGRATION

As a direct result of the recommendations contained in the NAICOM/MIS study and subsequent approval of the CNOCOM/MIS implementation plan in February 1969, separate but related actions were taken by the CNO Information Systems Branch (OP-912). One such activity was an organizational review of certain development and implementations of information systems. Another task, for which technical support was provided by the Planning Research Corporation (PRC), was a CNOCOM/MIS study which was conducted during the period April to October, 1969. The objective of this study was to develop an operational concept for CNOCOM/MIS that would specify the procedures and facilities necessary to permit effective staff interaction with this highly automated information system.

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[1] *Ibid.*, pp. 1-2.

The Information Systems Division conducted a survey concurrently with the above PRC study, to determine the information requirements of the OPNAV offices (OP's) for CNOCOM/MIS. This survey consisted of interviews, organizational and decision center analyses, flow path studies, reporting requirements and functional relationships. As the study group completed each OPNAV office, they prepared Interim Working Papers. After accumulating all of these papers they consolidated the data into a final technical report[1] containing survey findings on information processes, existing and proposed automated and non-automated systems, unfilled information requirements and recommendations on the possible integration of these into the overall CNOCOM/MIS plan.

CURRENT SYSTEMS ANALYSIS

The Final Report revealed that the Naval Command Systems Support Activity (NAVCOSSACT), the Navy Information Center (NAVIC) and other Naval installations for which the OPNAV offices are sponsors, sources of input, or recipients of output held a myriad of differing hardware and software combinations. At NAVCOSSACT and NAVIC there were thirty-one major systems in existence which were utilizing five types

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[1]U. S. Department of the Navy, NAVCOSSACT Document No. 40A504 TR-19, CNOCOM/MIS Survey of Information Requirements, November, 1969.

of central processing unit configurations and a total of nine different compilers. Many of the systems were written in two or more software languages, causing further confusion. There were eight systems reviewed which were operated at installations other than NAVCOSSACT and NAVIC. These systems employed four distinct hardware sets, five compilers and an unrecorded number of assemblers. In addition to the foregoing operational systems, twenty new systems were found to be either under development or proposed for development at the activities studied. This study bears out the intense need for standardization.[1]

REQUIREMENTS IDENTIFICATION

The total range of systems studied had been or were being developed to fulfill such needs as:

(1) Mobilization requirements for Army, Air Force and Coast Guard personnel.

(2) Flag Plot information required by SECNAV, CNO and the Joint Chiefs of Staff (JCS).

(3) Aviation statistics and reports.

(4) Fuel and ammunition inventories and planned requirements.

(5) Nuclear weapons information.

(6) Congressional inquiries.

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[1] Ibid., pp. 15-21.

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(7) War game strategies.

(8) Navy cost information.

(9) Registered publications inventories.

(10) Southeast Asian Operations data.

(11) Manpower management information.

(12) Research and development and a multitude of others.[1]

Aside from the many and varied requirements which were being met by the existing systems, the study group uncovered still more needs that were not being met. Eight of the eighteen OP Codes surveyed, had such unfilled requirements. (OP Codes and their missions are contained in Appendix A.) A summarization of the existing systems and future systems related to their users are shown in Appendices B and C respectively. Appendix D contains a list of activities which require additional information and the type of data needed by each.

As a result of the survey, sponsors were assigned for each system. However, certain systems generated information which could be used by many offices. An example of this is the Navy Cost Information System sponsored by the Navy Comptroller but used by ten OPNAV offices. To avoid overlap of file maintenance responsibility in these situations where the systems cross organizational lines the

[1] Ibid., pp. 8-22.

study group[1] determined it most feasible to designate only the prime or largest user as the sponsor. The sponsors responsibility is to purge the system files of unnecessary information and update the remainder in preparation for incorporation into the CNOCOM/MIS integrated data base.

The requirements had been identified, and owing to the nature of CNOCOM/MIS the designers decided that, until the system became fully operational, the users would be limited to top-level management (i.e., CNO and his staff). The concept would provide for information support to the entire CNO staff as well as outside organizations such as SECNAV and JCS. The data base will be maintained by the OPNAV organization codes assigned the sponsorship responsibilities. It is anticipated by the OPNAV designers that in the short range future (5-10 years) that the media may be expanded, for both service and maintenance, to the middle management echelon at the Fleet level.[2] However, this presupposes major technological advancements in the digital data transmission field over the next half decade. Concerning this media, W. M. Ellinghaus, President, New York Telephone Company, speaking as an affiliate of AT&T stated:

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[1]Interview with Sarah Pillar, Head, Data Base Subsystem (CNOCOM/MIS) Branch, Washington, D. C. on January 25, 1971.

[2]*Ibid.*

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> In the next ten years we plan a fourfold increase . . . .It will not consist of more and more of the same but will incorporate facilities that are in the laboratory today and promise vastly increased capacity--at lower and lower costs as the decade unfolds.[1]

He further announced that an all digital network (as opposed to the existing analog) is planned by AT&T by 1975.[2]

SYSTEMS CONVERSION PROCESS

Concurrent with the aforementioned NAICOM/MIS Study, the PRC Study and the general identification and analysis of CNOCOM/MIS requirements procurement negotiations were underway for a third generation system to augment the existing 7090/1401-10 installation at NAVCOSSACT.[3] Although not formally defined at the outset of the purchase action, the projected CNOCOM/MIS system requirements were included in the specification package established for the new hardware. The contract was awarded to the UNIVAC Division of Sperry Rand Corporation to install a Dual Processor 1108 system at NAVCOSSACT. (Appendix E). While this system is planned initially to augment the 7090/1401-10 the long range plan is to convert all existing applications to the 1108. This projection is possible due to the increased capacity and

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[1]Herbert Nolan, "Moving Business Data is Big Business," <u>Business Automation</u>, December, 1970, p. 20.

[2]<u>Ibid</u>.

[3]Interview with John Schauer, Technical Assistant, Chief of Naval Operations Information Systems Branch (OP-912T), Washington, D. C. on January 20, 1971.

speed of third generation hardware in conjunction with the sophisticated software being designed into CNOCOM/MIS. Together these features will fully utilize the multi-program processing capability brought about by the third generation technology.

Maintenance of existing applications necessitated further analysis of the existing and planned applications in order to bring about the most effective conversion plan. This phase of conversion primarily addressed the total system software conversion to the 1108, as contrasted to the data base conversion and its integration into the CNOCOM/MIS data base. This latter conversion will be discussed in Chapter III.

In the project request, CNO assigned NAVCOSSACT the selection of systems and programs to be considered for conversion and restricted conversion to these systems where a minimum of reprogramming from one language to another was feasible. The project request specified three tasks:

a. Develop guidelines and specific criteria in conjunction with the Design Team for selecting systems and programs for conversion.
b. Analyze NAVIC operational programs, and all functional area conversion requirements provided by CNOCOM/MIS Design Team Members and other NAVIC users, in order to develop an overall conversion plan.
c. Prepare a time phased conversion plan and submit to OP-91 for approval.[1]

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[1]U. S. Department of the Navy, NAVCOSSACT Document No. 40A510 TR-01, CNOCOM/MIS Conversion Plan, June 1,1970, Appendix D.

The evaluation technique used by NAVCOSSACT considered the physical and processing characteristics of the system, its potential utilization and sponsor priorities. The evaluation process itself was divided into three phases which were to: (1) establish criteria, (2) gather system information pertinent to the criteria; and (3) correlate system information with the criteria.

The criteria developed for evaluation were placed into three major groups: status, characteristics and processing.

a. Status--With respect to status, the considerations were: The responsiveness of the system to the sponsor and its compatibility with the CNOCOM/MIS requirements; the relative priority assigned by the sponsor and its expected life span; the condition of documentation and availability or source material; and finally, the availability of analysts/programmers knowledgeable of the system.

b. Characteristics--The characteristics pertinent to a conversion decision which were reviewed were: the language or languages used for each program; the number of programs; special hardware requirements; special software requirements; and the general complexity of the system.

c. Processing--The interface requirements, run time frequency as well as the estimated time and effort required for conversion were comprised in the processing criteria factor.

During the information gathering phase the NAVCOSSACT personnel researched various sources. In general, the information pertaining to characteristics and processing were provided by NAVIC. In addition, CNOCOM/MIS module leaders provided information pertaining to the system background and potential planned into the design structure, as will be seen in Chapter III.

In the final major phase of conversion analysis, correlation of criteria and system information, the compatibility of programming languages was given foremost consideration. The programs which had been chosen as benchmarks for the selection of the third generation equipment had demonstrated that COBOL and FORTRAN could be adopted to compile on the 1108 with a minimum of revision. The other major language used on the 7090 was the Macro Assembly Program (MAP) which was found to be incompatible with the 1108. Due to the large number of programs existing which utilized this assembler, much consideration was devoted to the development of a translator program to convert them. Although this method is possible, further analysis revealed that most of the programs assembled with MAP were older versions and if converted satisfactorily would still not attain the level of software sophistication which will be required by CNOCOM/MIS. Therefore, those systems or programs, for which MAP was the principle language, were considered

poor candidates for conversion and would be redesigned and programmed specifically for the third generation system.[1]

There were thirty-four systems evaluated as candidates for conversion. Fourteen of these systems, consisting of 231 runs written in COBOL and FORTRAN, were selected for conversion.[2] At the time of the study it was estimated that 707 man months of effort would be required to complete this phase of the conversion task. At the present time practically all of this phase has been completed.[3]

Seventeen of the systems reviewed were selected for immediate or eventual redesign prior to implementation on the 1108. These were generally the older systems written in MAP. However, in some instances the analysis revealed that changes in user requirements made redesign more practical.[4]

Finally, the evaluation team determined that the requirements for three of the systems could be satisfied by software available with the 1108. These were scheduled for replacement.[5]

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[1] Ibid.,p. 13.

[2] Ibid., p. 19.

[3] Interview with Sarah Pillar, op. cit.

[4] U. S. Department of the Navy, CNOCOM/MIS Conversion Plan, op. cit., p. 19.

[5] Ibid., p. 18.

COMMENTS

The analysts anticipate that it will take from two to four years to accomplish the complete transfer from the 7090 to the 1108.[1] While this timeframe, due to its range, appears to be no more than a guess--at least it is a beginning toward the mammoth task of developing a futuristic computerized management information system. William Zani, speaking with regard to past attempts at system design has stated: "Traditionally, management information systems have not really been designed at all. They have been spun off as by-products of the process of automating or improving existing systems . . . ."[2] He referred to this inadequate method as the "bottom-up" fashion. Zani continued on to say:

> If the design of management information systems begins on a high conceptional level and on a high managerial level as well, a company can avoid the "botton-up" design phenomenon of recent history and begin to develop the real, and very great potential of MIS as a tool for modern management.[3]

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[1] Ibid, pp. 19-20.

[2] William M. Zani, "Blueprint for MIS," Harvard Business Review, November - December, 1968, p. 95.

[3] Ibid., p. 100.

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The analysis [illegible] that it will take [illegible] to five years to [illegible] the complete [illegible] from the [illegible] to the [illegible].[1] [illegible] this [illegible], [illegible] of the [illegible] [illegible] [illegible] [illegible]--at least [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] management information system. [illegible] [illegible], [illegible] with regard to [illegible] [illegible] [illegible] [illegible] [illegible]: "Traditionally, management information systems have not really been designed at all. They have been [illegible] as [illegible] of the [illegible] of [illegible] or [illegible] [illegible] [illegible] . . . ."[2] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] of the "[illegible]" [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible]:

> If the design of management information systems [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] as well, a [illegible] [illegible] [illegible] [illegible] "[illegible]" [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] development.[3]

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[1] Ibid., pp. [illegible].

[2] [illegible] [illegible], "[illegible] [illegible] [illegible]," *[illegible] [illegible] [illegible]* [illegible], [illegible], p. [illegible].

[3] *Ibid.*, p. [illegible].

CHAPTER III

A LOOK AT EXISTING DATA WITH RESPECT TO SYSTEM DESIGN

Management information system design determines the operating characteristics of a system. Fundamental to system design, however, is the definition of system objectives which must be determined very early in the planning phase. Unless these goals are clear and realistic, a responsive system cannot be designed. The failure of management to set such goals will hamper management's control over the development and the entire operation of the system. Documented system objectives prevent ambiguity and serve as the tool to measure progress and performance during the development and operational stages.

The design of a management information system also requires the definition of system functions which represents the operational requirements of the system. It must be able to receive, process, store, and produce information as required.

Although management information systems are usually file-oriented, requiring large files of information which

comprise the data base of the system, the system must be developed independent of the media that will affect it. R. L. Martino, in one of his recent publications, made the statement that, "An MIS is completely defined when we have established its elements . . . and the decisions that link them."[1]

This chapter has been arranged on the basis of Martino's theory in order to give the reader a knowledge of the "heart" of the system before studying the interacting operational functions/subsystems which will be described in Chapter IV. Following the overview of the basic CNOCOM/MIS principles and procedural tools which will be described in this chapter, there will be a discussion of the construction of the data base as a function of the overall system design.

CNOCOM/MIS DESCRIPTION

The system is comprised of a series of integrated subsystems, designed to fulfill the present and future information requirements of the OPNAV staff, allowing them to perform their support functions in a more efficient and effective manner. A subsystem, in the context of CNOCOM/MIS, is a logical grouping of major OPNAV functions and processes so ordered as to provide for the efficient and coordinated

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[1]R. L. Martino, MIS-Management Information Systems, (Wayne, Pa.: Management Development Institute Publications, 1969), p. 91.

development of the entire system.[1] CNOCOM/MIS is a large and complex system created to provide for the information support of the CNO and his staff as well as outside organizations requiring communication interface with the CNO. The employment of the subsystem technique and other new approaches were used in the design and are being used to develop the system into a single integrated package.

The limits of each subsystem are defined by groups of related functions, either by decision-process criteria or by information-content criteria. The CNOCOM/MIS structure embodies twelve subsystems. Six of these are considered to be nonfunctional since they are independent from, but are used with, any or all of the operational programs. The nonfunctional subsystems are: Equipment, Software, Data Base, Input, Output, and Service. The remaining six subsystems are the operational types referred to herein as functional. Included as functional subsystems are: Executive, Planning, Programming/Budgeting/Resource Control, Command, Staff Services, and Management. A graphic representation of the interface involved among these subsystems is shown in Figure III-1. It is an attempt to make the functional and nonfunctional distinction more readily apparent while illustrating the need for interface among the subsystems.

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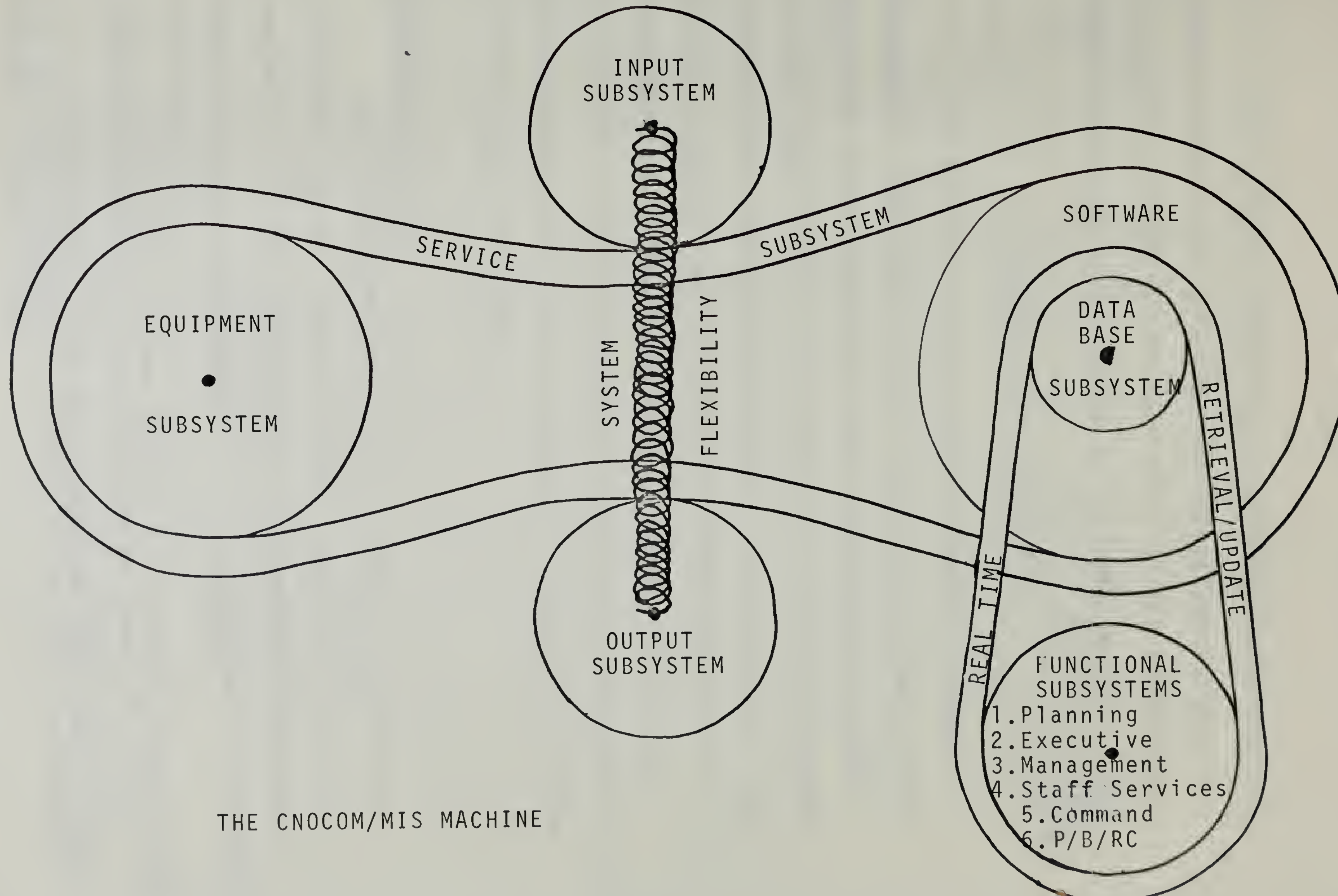
[1] U. S. Department of the Navy, NAVCOSSACT Document No. 40A503 TR-01, CNOCOM/MIS System Design Proposal, Description and Implementation Plan, July, 1970, p. 21.



THE CNOCOM/MIS MACHINE

FIGURE III-1

This chapter describes the development of the system's basic tools prior to any discussion of the integrated utilization of these tools in the operational system which will be presented in the next chapter.

NONFUNCTIONAL SUBSYSTEMS

The term "nonfunctional," as applied to these subsystems, signifies indirect support of system users as opposed to those subsystems which are directly mission oriented (functional). In addition to providing indirect support to the mission oriented parts of the system, these software segments are the framework around which the organizational entity known as the CNOCOM/MIS Systems Service[1] is built. The following pages will provide a general description of the subsystem's contents and roles in the integrated system.

Software Subsystem

This subsystem consists of a body of coordinated principles[2] and the related actions required in order to provide all of the nonfunctional software for CNOCOM/MIS. These principles are essential to the subsystem since software

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[1]CNOCOM/MIS Systems Service is an OPNAV organizational entity which operates as an ADP service bureau for OPNAV.

[2]"Principles," as used throughout this paper, refers to a set of working rules relevant to the function being described or performed.

which will be incorporated into the system will originate from hardware manufacturers, software contractors and from the existing second generation software with which the CNOCOM/MIS must interface. Software can never be assumed to be static. It is, and will continue to be, affected by the equipment configuration used as well as the hardware of the interfacing systems. Compilers and assemblers may have to be augmented to facilitate handling of specific tasks, but most important, data management systems (DMS) must be studied to determine the need for and benefits to be gained from such systems. At this time, no DMS which has been analyzed will completely satisfy the specifications necessary to complement and enhance the advanced system being developed. The changing data transmission/communication media causes still another software problem. There is a continuing effort on the part of telecommunication experts to perfect an all-digital network which will permit wider computer-to-computer communication.[1]

The principles of this subsystem include:

(1) Providing flexible selections of required assemblers/compilers for source/machine languages (e.g., "ANSI COBOL," "FORTRAN," etc.).
(2) Fulfillment of CNOCOM/MIS-wide software requirements.

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[1]Herbert Nolan, "Moving Business Data," op. cit. pp. 20-21.

(3) Maintaining software interfaces, not only among CNOCOM/MIS Subsystems, but also with higher, equal, or lower level systems and communications networks (e.g., integrating CNOCOM/MIS and LDMX software).
(4) Coordination of manufacturer and other software contributions to the subsystem, including its operating compiler/assembler, data management, and special capability components.
(5) Augmenting manufacturer capabilities with other capabilities based on demonstrable needs which cannot be otherwise satisfied (e.g., software for simulation or automatic flow charting).
(6) Exploiting the direct access capabilities of the available equipment configuration in consonance with the Equipment Subsystem's principles.
(7) Providing nonfunctional software support in response to functional subsystem requirements based on NAVCOSSACT's development and/or selection of the optimum DMS and the need to augment the manufacturer's software capabilities during various CNOCOM/MIS development phases.
(8) Ensuring software responsiveness to equipment configuration or reconfiguration needs.
(9) Interim consolidation, for management purposes, of second-generation software maintenance pending its replacement by third-generation equivalents.[1]

The Software Subsystem consists of five modules which are: Operating (system); Compiler/Assembler; Data Management (system); Second Generation Software; and, Special Capabilities. (See Figure III-2)

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[1] U. S. Department of the Navy, <u>CNOCOM/MIS System Design Proposal</u>, <u>op. cit</u>., pp. 27-28.

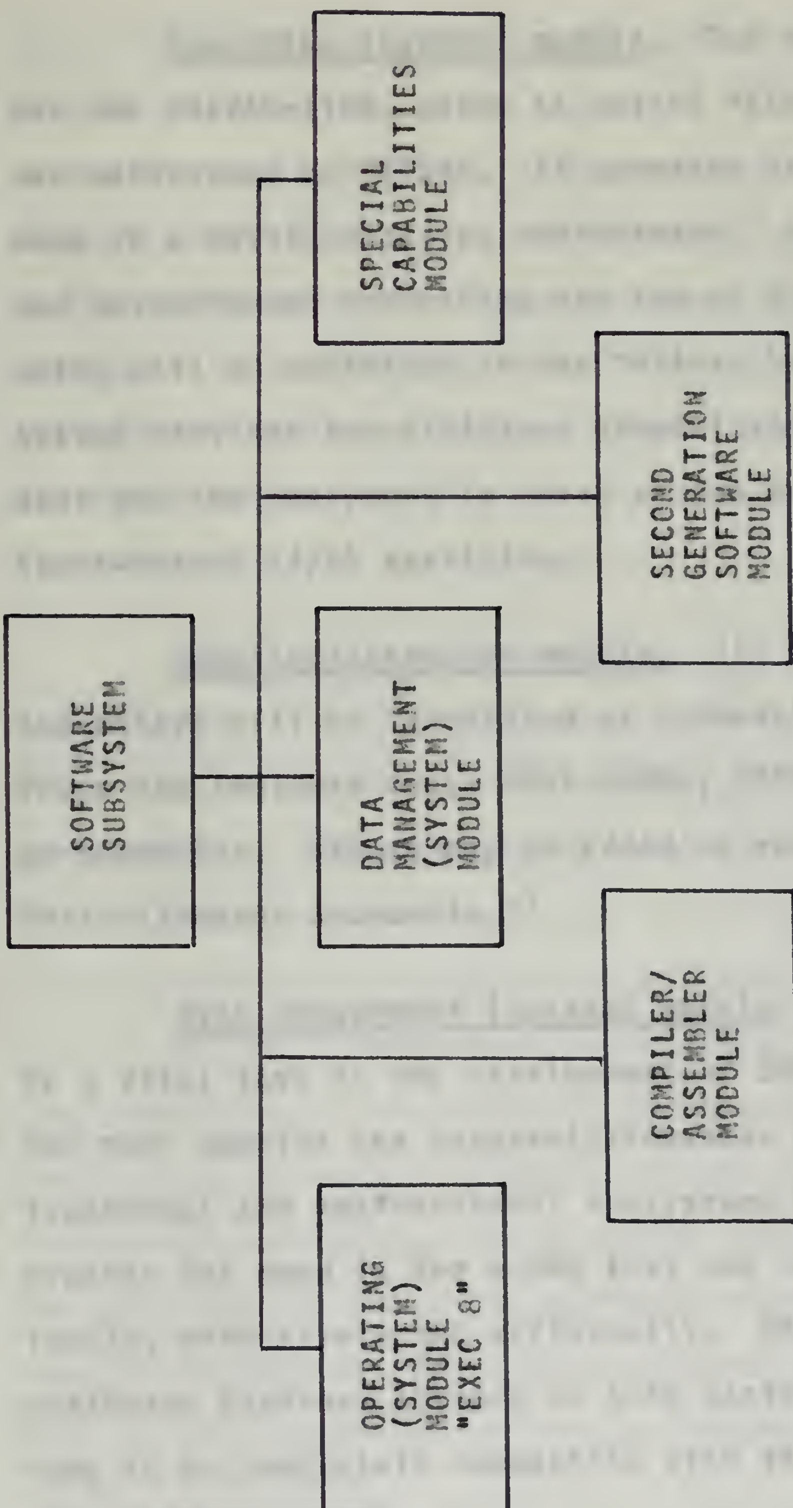
SOFTWARE SUBSYSTEM
SPECIAL CAPABILITIES MODULE
SECOND GENERATION SOFTWARE MODULE
DATA MANAGEMENT (SYSTEM) MODULE
COMPILER/ ASSEMBLER MODULE
OPERATING (SYSTEM) MODULE "EXEC 8"

FIGURE III-2

Operating (system) module. The operating system for the UNIVAC-1108, which is called "EXEC 8" is written and maintained by UNIVAC. It operates in a multiprogramming mode in a multiprocessing environment. Remote input/retrieval and asynchronous processing are two of the futures of "EXEC 8" which will be exploited to the fullest by CNOCOM/MIS. This system provides for efficient communication between the user and the equipment in areas of job scheduling and input-output (I/O) servicing.

Compiler/assembler module. All the compilers and assemblers will be identified as submodules to this module. Those now included are: ANSI COBOL, FORTRAN V, JOVIAL and an assembler. Others may be added as required under a "Miscellaneous Submodule."[1]

Data management (system) module. Data Management is a vital task in the development of CNOCOM/MIS applications. The more complex the interrelationships of the various functional and nonfunctional subsystems becomes, the greater the need is for a DMS that can handle files expediently, effectively and efficiently. NAVCOSSACT has evaluated eighteen systems on this basis and have found none to be completely compatible with the needs of CNOCOM/MIS.

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[1]U. S. Department of the Navy, CNOCOM/MIS System Design Proposal, op. cit., p. 56.

Those evaluated identified with their producers are: "CFSS" (Service Bureau Corporation); "COGENT III" (CSC); "DIPS" (NAVCOSSACT); "DM-1" (Auerbach); "DMS" (Whitlow); "FORGE" (Burroughs); "GIM" (TRW); "GIS" (IBM); "IDS" (GE); "IMS" (IBM); "MARK IV" (Informatics); "NIPS" (NMCSSC); "PRISM" (Cybernetics); "RAPID" (CDC); "RFMS" (University of Texas); "SCORE" (Atlantic Software); "TDMS" (SDC); and "XIMS" (UNIVAC).[1] (A more detailed description of the evaluation process will be addressed later in this paper.)

<u>Second generation software module</u>. The principles and actions related to this module specifically include directing, managing, and/or monitoring the second generation software. By its very nature, in a third-generation environment, this module is temporary. Its function will be relegated to the capacity of case-by-case maintenance until all systems have been either converted or redesigned for third-generation implementation. Conversion or redesign of programs written for second generation hardware is necessary in order to fully utilize the advantages of increased processing speed and the more capable executive software provided in a third generation system. After that has been completed the module will remain dormant unless it is further required when, and if,

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[1]U. S. Department of the Navy, NAVCOSSACT Document No. 51A002 TR-01, <u>A Study and Evaluation of Data Management Systems</u>, May 1969, p. 15.

[illegible]

[illegible]

[illegible]

more elaborate communication facilities necessitate interface with second generation software at remote sites.

Special capabilities module. This module consists of seven submodules which include utility programs and routines which will assist programmers in the areas of documentation, sorting, conversion, editing and canned mathematics routines. Presently available from the manufacturer are "SORT/MERGE," "PERT," "MATH-PACK/STAT/PACK," "DOC" and "UNADS." The last two are text editing programs used in preparation of documentation. Programs for automatic flow-charting and simulation, which are not available from UNIVAC will be purchased from another vendor.

Equipment Subsystem

This subsystem consists of a collection of software principles that govern the optimum utilization and integration of on-site hardware, remote terminals and communication capabilities within the CNOCOM/MIS workload definition. The function to be performed by the Equipment Subsystem is to reduce the requirements placed upon it to specific equipment tasks providing the necessary interfacing with external systems and communications networks. The scope of equipment so controlled includes all of that which is required to support the CNO and his staff.

The principles which define the task of the Equipment Subsystem are to provide:

(1) An integrated network of computers, peripheral devices, communications and remote terminal configurations.
(2) Improved reliability and ensured continuity of operation.
(3) Data processing and transmission speeds capable of concurrently supporting a variety of CNOCOM/MIS applications.
(4) Adequate capacity to meet current and future CNOCOM/MIS processing requirements.
(5) A communications network capable of supporting the exchange of secure information between remote terminals and the NAVIC Augmentation System in a timely manner.
(6) A random access capability.[1]

There are five modules embodied in the Equipment Subsystem which are: Remote Terminal Configuration Control; UNIVAC 1108 Equipment; Communications; Second Generation Equipment, and Other Components. (See Figures III-3) A description of each of the modules follows.

UNIVAC 1108 equipment module. The primary objective of this module is to provide for expanded data processing capabilities to augment the facility at NAVIC which, for years, has been at the saturation point. The recorded operating time over the past few years has slightly exceeded ninety percent. The idle time included both maintenance and down time.

In addition to the 1108, a UNIVAC 9300 Remote Batch Terminal at NAVIC will provide the OPNAV module leaders

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[1]U. S. Department of the Navy, CNOCOM/MIS System Design Proposal, op. cit., p. 32.

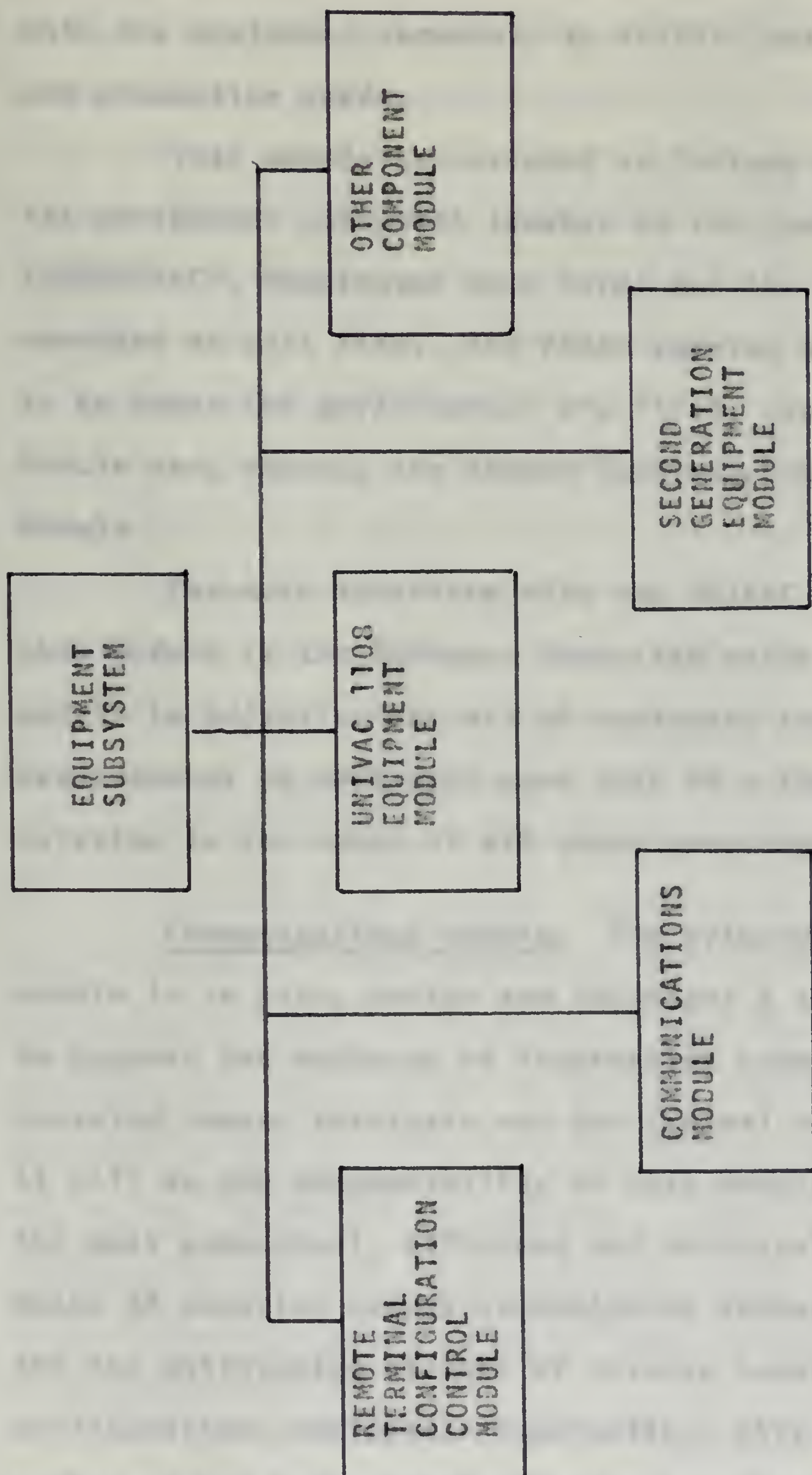
EQUIPMENT SUBSYSTEM
UNIVAC 1108 EQUIPMENT MODULE
SECOND GENERATION EQUIPMENT MODULE
OTHER COMPONENT MODULE
COMMUNICATIONS MODULE
REMOTE TERMINAL CONFIGURATION CONTROL MODULE

FIGURE III-3

with the equipment necessary to fulfill both their design and production needs.

This module is extended to include the 1108 and its peripheral equipment located at the computer site (NAVCOSSACT, Washington Navy Yard) and the remote terminals operated at that site. Any other remotes are considered to be under the jurisdiction of, first, the Communication Module and, second, the Remote Terminal Configuration Module.

The main interface with the UNIVAC 1108 Equipment this Module is the Software Subsystem which assists the module in adjusting the mix of equipment configuration requirements to meet each user task in a timely manner in relation to the needs of all other concurrent users.

Communications module. The primary task of this module is to plan, design and implement a secure network to support the exchange of information between user-operated remote terminals and the central computer site. It will be the responsibility of this module to seek out the most economical, efficient and technically feasible means of ensuring secure transmission between the mainframe and the anticipated mixture of diverse remote terminal configurations employed. Physically, this responsibility begins at the point where the data transmission is ready

to leave the 1108 and ends when the data enters the first element of any remote configuration. All equipment which lies between these two points are within the purview of the Communications Module Processes which will be included are logical switching, routine, multiplexing and queueing, all of which must be tightly controlled in order to optimize on both time and facilities while guarding the security classification of the data being transmitted. At the present time, there are no media available for digital transmission which will adequately handle classified/privileged and unclassified data simultaneously. Although such a feature was desired in the new equipment, when the procurement prepared the specifications for distribution to the hardware contractors for bidding, it had been eliminated since no manufacturer could produce equipment to such a stringent specification.[1] This troublesome area is under further investigation since maintenance of national security will prohibit mixed-mode operation until a completely satisfactory solution is found. This is probably the largest problem facing the CNOCOM/MIS environment. Likewise, it will probably be the sole factor limiting total system integration to top management and depriving the system of nearly

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[1]Interview with Sarah Pillar, op. cit.

direct access to the entire range of classified information being constantly generated by remote middle-managers.

Remote terminal configuration control module. The objective is to define the requirements for combinations of remote I/O devices in support of the needs of the OPNAV staff personnel and the principles to be invoked in their use. The scope of the governing principles begins where the Communication Module responsibility expires (i.e., at the first incoming element of any remote configuration). It includes standard interfacing devices required to control combinations of remotes and/or perform a multiplexing function.

Although the data-link requirements have been acknowledged and addressed by the module leaders in their equipment specifications, procurement of the actual remote devices has been held up due to a few significant factors which continue to be uncertain. One of the major problems to be surmounted is the one previously discussed with relation to the communications module-security.

Federal Standard 222 indicates the acceptable level of radio frequency (RF) radiation which may emanate from data transmission equipment. Three possible alternatives have been considered to overcome this problem, which are: (1) installation of RF shielding around all terminal devices; (2) procure only terminals that meet Federal Standard 222;

and (3) request waivers for terminals which will not meet the Federal standard.

First, the cost involved in the shielding alternative could make the use of remotes for handling secure data prohibitive. Secondly, as discussed earlier, there are currently no manufacturers with equipment capable of satisfying all of the needs of security which includes the restraints imposed by Federal Standard 222. Finally, after exhaustive research, the module leaders are tending more toward the dispensation approach. To date, however, this has not been done because it is a compromise and is not necessarily an adequate solution.

Second-generation equipment module. The scope of this module includes the responsibility for all second-generation computers and peripheral equipment for which procurement has been funded by CNO. It will consist of a perpetual inventory of this hardware which is available to provide the capability to reconfigure existing equipment for which CNO is responsible, in the event such an interface requirement emerges. When all intended users of CNOCOM/MIS have been converted to either third-generation hardware or have been provided with an adequate software interface with third-generation equipment, then this module will be phased out of CNOCOM/MIS.

[illegible]

[illegible]

[illegible]

[illegible]

<u>Other equipment module</u>. The primary objective of this segment will be to conduct an inventory of equipment not included in the other four equipment modules. It will necessitate conducting an initial inventory of all such equipment which includes, for example, electrical accounting machines, reproduction machines and labor saving devices, closed circuit televisions, time-sharing equipment (except that used in conjunction with the CNOCOM/MIS 1108), and third generation equipment other than the CNOCOM/MIS 1108 configuration.

<u>Data Base Subsystem</u>

The Data Base Subsystem is comprised of a set of principles and related actions as opposed to the data base itself (the accumulation of data upon which the subsystem principles and actions are applied). The principles consist of a data base maintenance and coordination role by which:

(1) The data base is updated or otherwise addressed.
(2) Storage locations of randomly-accessible data are automated.
(3) The content of the data base is recorded, whether or not part of that content itself is automated, (e.g., an automated record of unautomated data.)
(4) OPNAV--interest date elements and their specimens are named, defined, coded, and automated (e.g., the element "OP Code" and its specimens, "OP-01," "OP-03," etc.).
(5) OPNAV--interest data is translated into one or more of its diverse forms needed for total system coordination.

(6) Data is arranged for automated filing and identified with the fields, records, and files in which the data resides or will reside.
(7) Attribute data about units which are of interest to the Navy (not necessarily Navy's units) are automated.[1]

This subsystem will be user-oriented and its importance lies in the ability to accept data in either uniform or diverse form, record it, maintain it, index it, and cross-reference it for direct or quasi-direct access dependent upon the size of the file and the relative priority of the user. Files will include: those of general interest to OPNAV users, those of parochial interest, and summaries of either or both of the foregoing.

The Data Base Subsystem consists of five modules which are: Data Base Files Structure; Unit Information; Data Directory and Dictionary; Data Translation and Data Maintenance (See Figure III-4).

<u>Data directory and dictionary module</u>. This module has been subdivided into two separate submodules by the module leader since the functions of the directory, while closely related to that of the dictionary, are quite diverse in nature. This emphasis is made by the following comparison of the submodule principles.

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[1] U. S. Department of the Navy, <u>CNOCOM/MIS System Design Proposal</u>, <u>op. cit</u>., pp. 24, 26.

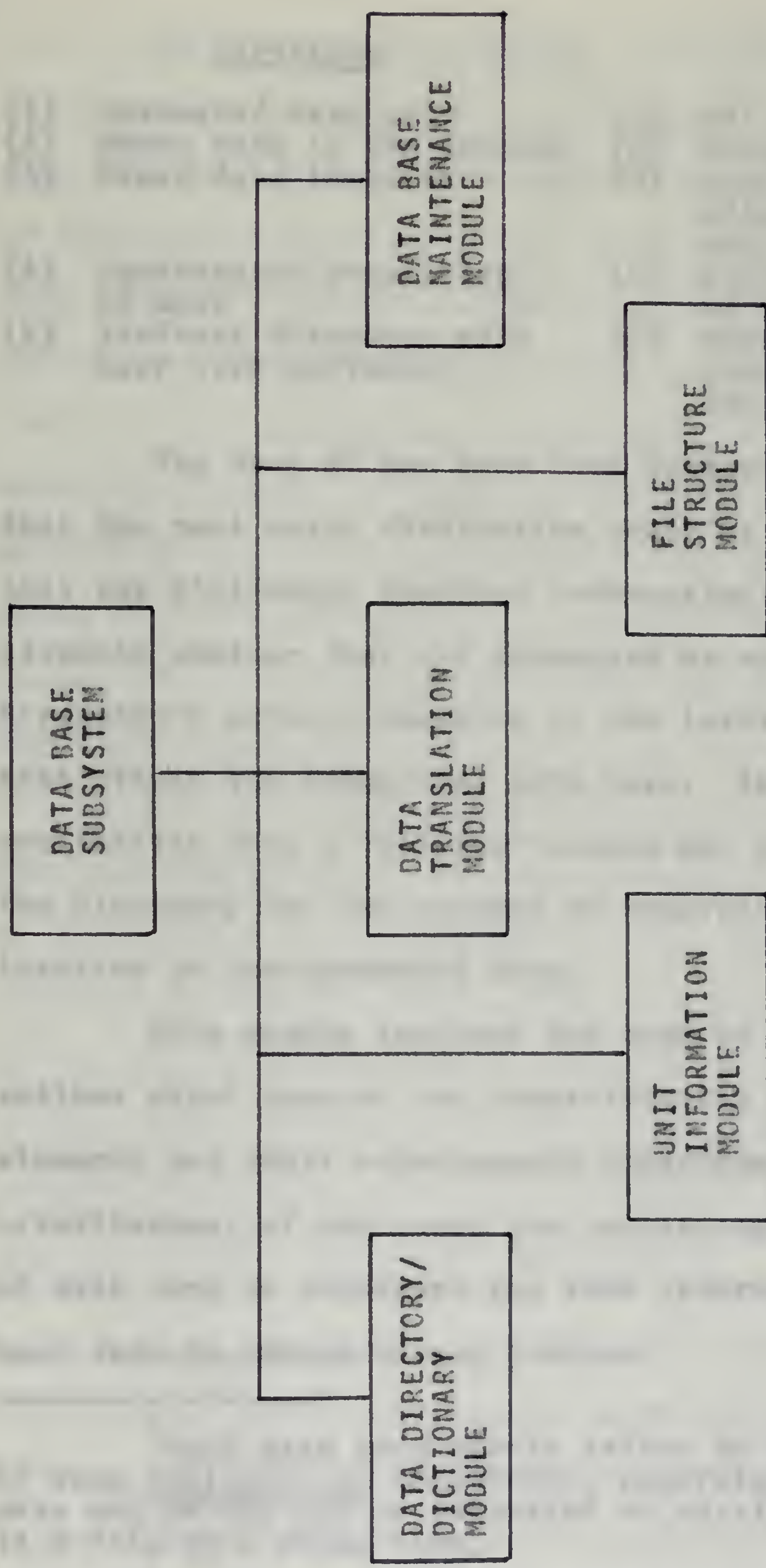
DATA BASE
SUBSYSTEM
DATA BASE
MAINTENANCE
MODULE
FILE
STRUCTURE
MODULE
DATA
TRANSLATION
MODULE
UNIT
INFORMATION
MODULE
DATA DIRECTORY/
DICTIONARY
MODULE

FIGURE III-4

Directory	Dictionary
(1) Automated data only	(1) All data in the base[1]
(2) Where data is (in system)	(2) What data is
(3) Coded data location	(3) Data names, definition, aliases correlation-links, etc.
(4) Coordinated processing of data	(4) Coordinated management of data
(5) Indirect discourse with user (via software)	(5) Direct discourse with user (via lists, publications, etc.)

The Head of the Data Base Subsystem Branch,[2] indicated that the most basic distinction could be drawn in the fact that the Dictionary contains information concerning data elements whether they are automated or not, while the Directory's primary function is the location of machinable data within the integrated data base. She indicated a possibility that a "pointer" system may be incorporated into the Directory for the purpose of retaining the external location of non-automated data.

This module includes the body of principles and actions which governs the identification of existing data elements and their sub-elements (specimens), the required establishment of new ones, the cataloging of diverse forms of data used to represent the same information, and locating such data in random access storage.

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[1] Data base used herein refers to the entire reservoir of data available to CNOCOM/MIS, regardless of whether such data may or may not be automated or physically incorporated in a file at a given time.

[2] Interview with Sarah Pillar, op. cit.

Unit information module. The applicable principles, and actions of this module are intended to be used to maintain data specifically attributable to the units that are of interest to the Navy (i.e., ships, aircraft, facilities). This data will be both variform and uniform dependent upon the files scanned. The principles of this module are: To identify what information about units is required; to determine the best sources of such information; to decide which data should be automated; to analyze the optimum means of tailoring output to satisfy each unit's information needs; and, to determine which data should be extracted from existing source data.

All unit information is subject to the scrutiny of the Data Directory and Dictionary Module before it is allowed to enter the data base initially. At one time or other the Unit Information Module will be used by every module of the Data Base Subsystem as well as interfacing with all nonfunctional subsystems as the need arises. It is also expected that this module will interface with most, if not all, of the functional subsystems.

Data translation module. This module identifies, correlates, displays for comparative analysis, and translates data which exists in a variety of forms into the standard form for all of that subject matter (e.g., USS

F. D. ROOSEVELT, F. D. ROOSEVELT and ROOSEVELT would all be synonymous). The concept of operation of this module is not only to identify synonyms or related variform elements of data, but also to continuously diminish the size of the data base by eliminating synonymous variform data, thus reducing repetition in the files.

The Input Subsystem (discussed later in this Chapter), provides the capability to establish, maintain and query any variform data found to exist in the data base. A predominant version of the variform will be selected as the standard by the Data Translation Module. However, the input of any one of the synonymous variforms will allow output of all aynonymous data required by the OPNAV users.

File structure module. The principles and related actions of this module are used to identify all of the data files available to CNOCOM/MIS and the specific content of each file. The concept under which it operates is to establish one record for each CNOCOM/MIS automated file. It further correlates these records and generates intra-file linkages in order for a relationship to exist among related data elements contained in different files. The link to all such data will reside in the Data Directory and Dictionary Module File.

The File Structure Module, in addition to establishing an individual record for each CNOCOM/MIS--interest file,

[illegible]

[illegible]

[illegible]

[illegible]

indicates its scope (e.g., Navy-wide), function (e.g., logistics), usage scope (e.g., DOD wide), originator (e.g., NAVCOSSACT), etc. The output products from this module's files will be used primarily by the Service Subsystem for data base management and system control.

Data base maintenance module. This module is responsible for ensuring the integrity of the data base content by coordination of its input and output supports. It will employ input which has already satisfied validation criteria of the Input Subsystem and in conjunction with the Software Subsystem will provide for all nonfunctional requirements for data base maintenance.

Some of the editing features involved when this module is interfaced with functional subsystems (in order to ensure complete integrated and standard updating of the data base) include: certified access, security clearance, identification of input type and its originator, diagnostic rejection data and data needed for routing control.

Auditing capabilities will include tracing of input data which was addressed to one or more fields for updating. This procedure will uncover broken links in the updating process, or identify those elements which are catalogued for updating regularly, but for which no data

has been received in the input cycle. In such instances the Data Sponsor would be notified to provide new data or have the update flag removed.

A limited search and retrieval capability, similar to the tracer concept previously described, will be programmed into this module along with the standards and operating procedures for the data base query process.

Input Subsystem

This subsystem will provide the mechanism for the collection of raw information input to the CNOCOM/MIS data base and the methods and procedures to incorporate the input requirements levied upon subordinate organizations by OPNAV into a single systematic entity. By these procedures the duplication of input requirements (data already being acquired) should be significantly reduced, and by working in conjunction with the Data Directory and Dictionary Module, the Data Translation Module and the Software Subsystem it will provide an effective means of controlling the information conveyed to the data base.

In essence, this subsystem has the ability to define the parameters, by which data either does or does not meet the criteria, for induction into the data base, and the logic and instructions to determine how the qualified and/or unqualified elements should be processed.

The Input Subsystem objectives and rules as follows:

(1) Increased automation of output to OPNAV.
(2) Reduction of reporting requirements.
(3) Provision of an integrated report directory and flexibility in sequencing directory content.
(4) Provision of an interface with other information systems and programs.
(5) Streamlining the method for the acquisition, control, validation, emission, and access for all data entering the automated data base.
(6) Automated support for reports management.[1]

The Input Subsystem is comprised of three modules: Input Requirements Analysis; Input Processing; and, Input Management. (See Figure III-5) A description of the module follows.

Input requirements analysis module. This module will provide the parameters, methods and procedures necessary to determine the sources of data for CNOCOM/MIS. The incoming data will be fully analyzed either by the System Service personnel, by computer, or both, in an effort to consolidate the reporting requirements placed on activities by eliminating duplication and selecting the best source to act as Data Sponsor. To do this, all input will be

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[1]U. S. Department of the Navy, CNOCOM/MIS System Design Proposal, op. cit., p. 24.

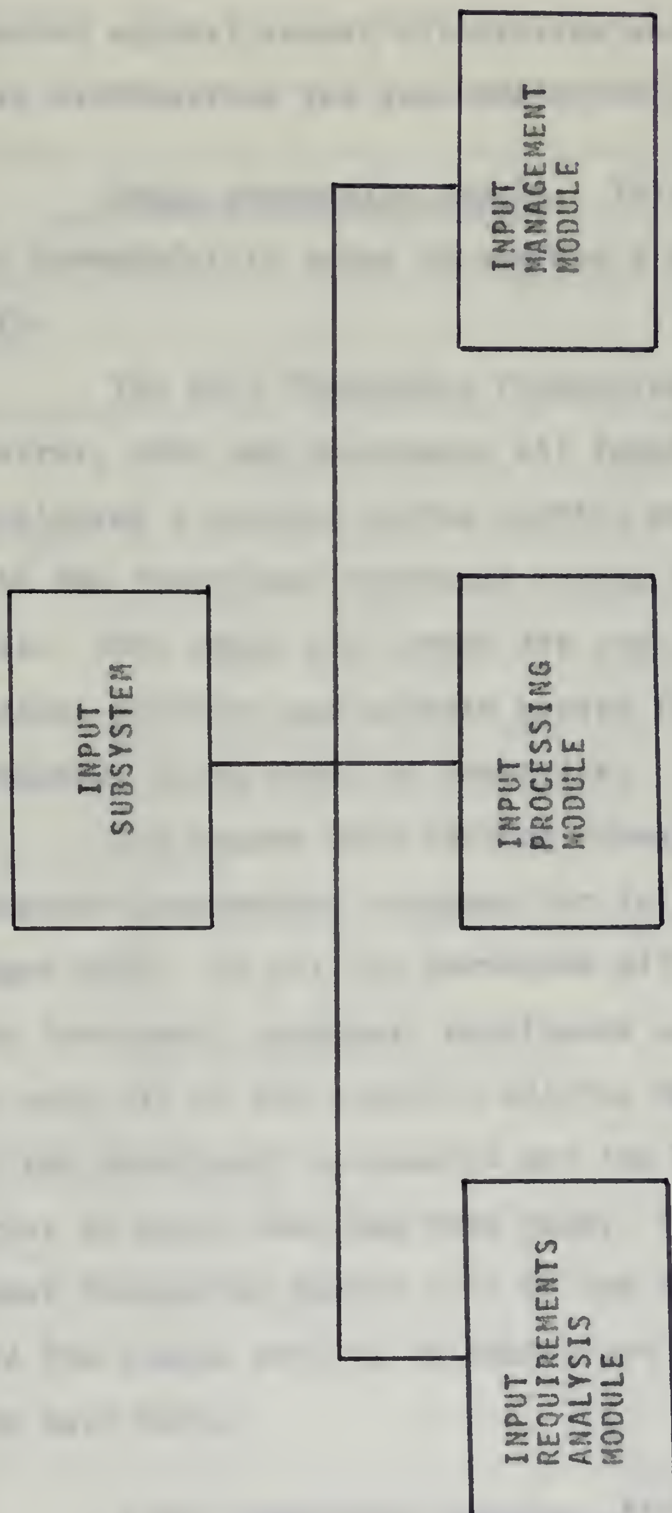
INPUT SUBSYSTEM
INPUT MANAGEMENT MODULE
INPUT PROCESSING MODULE
INPUT REQUIREMENTS ANALYSIS MODULE

FIGURE III-5

checked against report directories and dictionaries, data dictionaries and non-CNOCOM/MIS report inventories.

Input processing module. This module consists of two submodules in order to perform a dual purpose type of edit.

The Edit Processing Procedures Submodule will control, edit and preprocess all input data. This could be considered a cursory review carried out in coordination with the functional component having interest in the particular data. This phase will check for such items as classification, priority and certain errors in data in order to determine basic modes of operation.

The Source Data Editing Submodule will include the computer programming required for full editing of all input data. It will be performed with coordination from the functional component developers and will be tailored to meet all of the specific editing requirements necessary to the functional components and the Data Base Subsystem prior to entry into the data base. The input to the Input Processing Module will be raw data from any source and the output will be validated and ready for entry into the data base.

Input management module. The tools needed for the input data management function will be established in this

module. They will consist of instructions, controls and procedures necessary to manage the entire mass of input. A central record will be established for all input data in an Input Directory. This directory will be used to screen proposed information requests against extant data. It will contain the following information pertaining to each request that has passed through the Input Subsystem:

(1) CNOCOM/MIS Control Number (consecutive numbers assigned by System Service personnel)

(2) Input Identifier (name of the report of input data)

(3) Classification (security)

(4) Material Date (date when input data is due)

(5) Period Covered by Input (time span of data validity)

(6) Activity Submitting Report

(7) Data Sponsor

(8) Transmission Mode

Output Subsystem

This Subsystem is a representation of the needs of the users of all levels. It will be directly related to the functional subsystems and will be geared to the requirements specified by the users. The principles applied in the Output Subsystem require the cost-effective coordination and control of all output requirements. Its objective is to provide the information authorized to the requester in

the medium and format desired. It will provide interfacing methods, procedures, and certain computer programs necessary to manage, control and produce the desired output. Although most of the programs tailored to specific output requirements will be accomplished as part of the cognizant functional subsystem, all output must be in conformance with the standards and procedures developed in the subsystem.

The Output Subsystem consists of three modules: Output Requirements Determination; Output Processing; and, Output Management. (See Figure III-6)

<u>Output requirements determination module</u>. From this module, the methods, procedures and standards for analyzing the requirements for information retrieval will be derived. This capability will support OPNAV through the System Service.

<u>Output processing module</u>. The methods, procedures and controls for all output producing programs and other operational functions necessary to format, prepare and assemble output materials will be included in this module. The procedures prepared herein include special handling for classified data, high priority control, and erroneous data routines. External programs used in processing output will be controlled. Certain general purpose programs will be

[illegible]

[illegible]

[illegible]

[illegible]

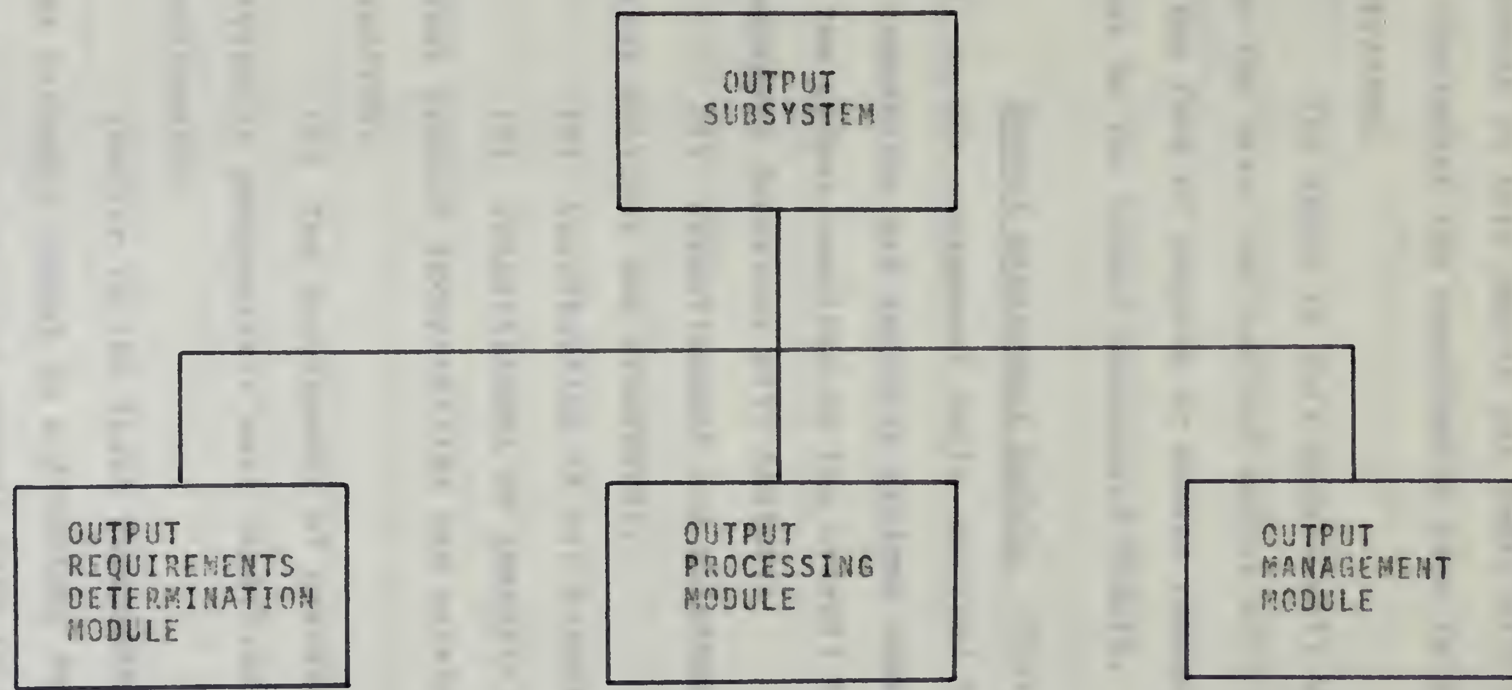
OUTPUT
SUBSYSTEM
OUTPUT
REQUIREMENTS
DETERMINATION
MODULE
OUTPUT
PROCESSING
MODULE
OUTPUT
MANAGEMENT
MODULE

FIGURE III-6

inherent to this module but these will be strictly routine to complement the programming done in the functional subsystems.

The input to this module will be the data retrieved from the data base and the output will consist of this data in the form of reports or demand responses which will be input to the Output Management Module.

Output management module. Provided by this module will be the management tools required for the coordination of scheduling and security systems necessary for preparation of the output required by the overall system. Output management functions will include:

(1) Establishment and maintenance of CNOCOM/MIS output policies and procedures.

(2) Coordination of all output.

(3) Establishment of concepts pertaining to output product acceptability and maintenance of those standards.

(4) The development of procedures for reworking previously unacceptable work consistent with the scheduling requirements.

Similar to the Input Management Module, this module logs proposed output in a directory for screening against previously registered reports data in the dictionary, and formats available in the dictionary, in an effort to prevent

duplication by bringing it to the user's attention. Elements of data contained in this Output Directory will be:

(1) CNOCOM/MIS output Control Number (consecutive number assigned by the Service Subsystem)

(2) Output Report/Data Title (name and brief description)

(3) Classification (security

(4) Activity Requesting Report

(5) CNOCOM/MIS Design Control Number (the individual functional component's identification number)[1]

(6) Application Sponsor

(7) Transmission Mode

Service Subsystem

This subsystem will provide the OPNAV staff with the system analysis and procedural development necessary for the fruition of standardization, integration and the general smooth functioning of CNOCOM/MIS.

It provides the methods and procedures to determine the validity of new requirements on the data base. Further procedures established will include such areas as certifying authority to determine what types of data should be admitted to the data base and who should have access.

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[1] *Ibid.*, Appendix D.

In conjunction with the Input and Output Subsystems, this subsystem will provide the mechanism for determining whether the existing capabilities can be reworked to satisfy the request or if a totally new requirement has to be recognized and a new capability provided.

The Service Subsystem is made up of three modules, which are: Data Base Management; System Control Procedures; and, Customer Services. (See Figure III-7)

Data base management module. This will include procedures necessary to support the CNOCOM/MIS System Service in the following ways: Coordination of data base requirements; standardization of data type; entry and purging of data from the data base; and, maintaining accounting records and performing budget and planning functions related to the data base. In all of these instances, there must be complete coordination with the Data Base Subsystem.

System control procedures module. Administrative policy, procedures and controls will be a function of this module. System Service personnel will perform the following functions under the authority delegated by the Certifying Authority, the Vice Chief of Naval Operations (VCNO): designation of organizations to perform functional roles; granting authorization for access to data; recommendation of designated users to VCNO; approval of data request cancellations;

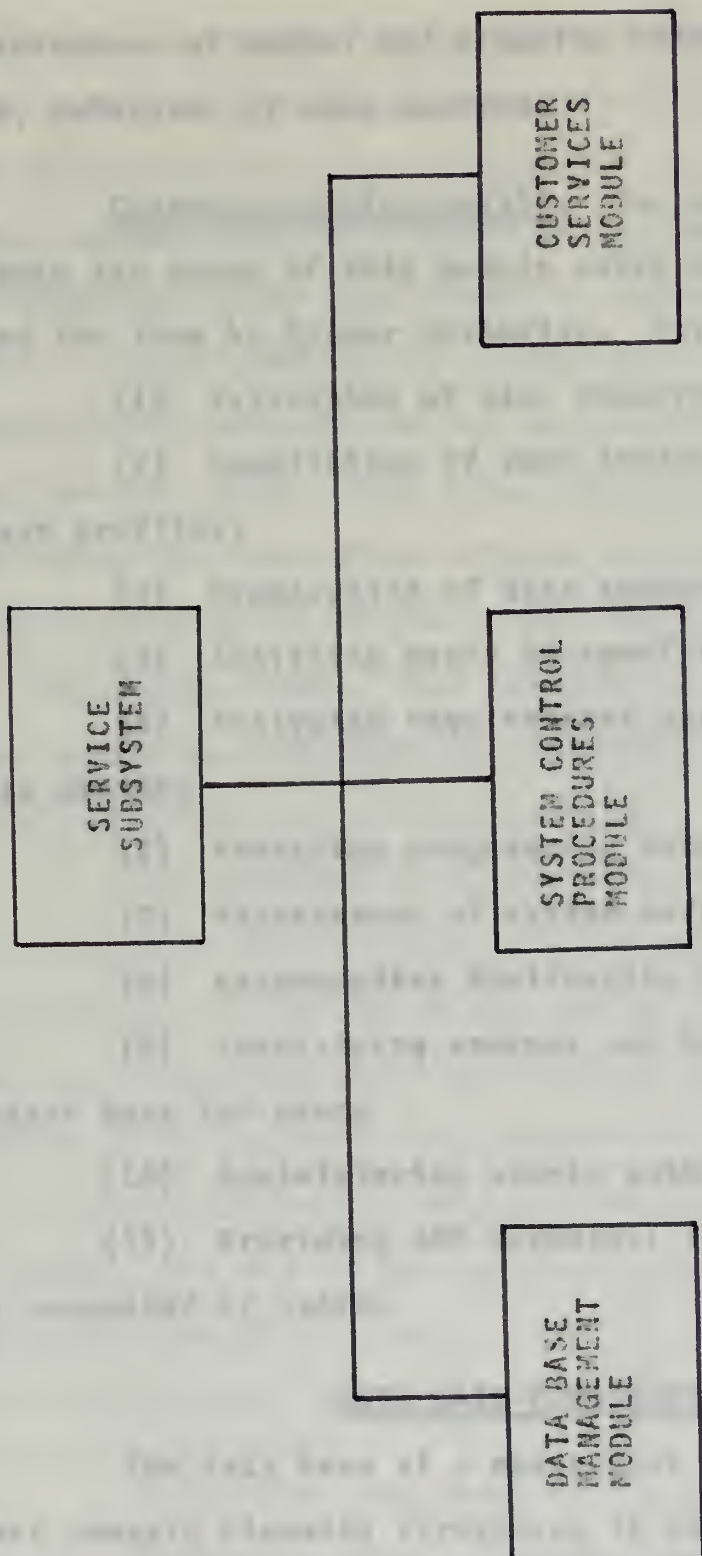
SERVICE SUBSYSTEM
CUSTOMER SERVICES MODULE
SYSTEM CONTROL PROCEDURES MODULE
DATA BASE MANAGEMENT MODULE

FIGURE III-7

development of budget and planning information for CNOCOM/MIS; and, selection of data sources.

Customer service module. The personnel included within the scope of this module carry out the procedures developed for them by higher authority. Their tasks will include:

(1) Validation of user requirements

(2) Compilation of user subject--interest listings (user profiles)

(3) Preparation of data sponsor/user designation

(4) Assisting users in specfying requirements

(5) Analyzing requirements against existing data base content

(6) Providing programming service (limited)

(7) Maintenance of system software integrity

(8) Recommending Application Sponsors

(9) Identifying sources and initiating action to obtain data for users

(10) Administering access authorizations

(11) Providing ADP technical advice or referral as requested by users.

DATA BASE CONSTRUCTION

The data base of a management information system must contain elements structured in such a way to form a workable base for the system operation. If the nonfunctional

subsystems designed into a system could be referred to as the "heart" of a system, then certainly the data base would be considered to be the "lifeblood" of that system. Without the latter element the former has no need to function, and without the former the latter is useless.[1]

In the CNOCOM/MIS concept, the middle management echelon will provide the top management staff with input for the data base. This data will be adequately massaged by the appropriate OPNAV offices to check it for validity before it is given to the System Service personnel for input to the system files. (See Appendix A) Top management can then query the data base for information to assist in decision making and policy planning.

"The information elements in the data base must be structured into a workable information base. This structuring is the key to the system . . ."[2] and is one of the most important considerations to the designers. The degree of relationship and integration of the data elements will vary considerably depending on the source of the elements, the mix of the variables used in a solution and the objective of the user. Ideally, however, a code or descriptive data field will be constructed in such a manner

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[1]Interview with Sarah Pillar, op. cit.

[2]Norman L. Enger, Putting MIS to Work; Managing the Management Information System, (New York: American Management Assoc., Inc., 1969), p. 41.

that it will suffice for the needs of any user. For example, a Unit Identification Code (UIC) should connote the same meaning to the Captain of a ship as it does to the Comptroller of the Navy, the CNO, or the Secretary of Defense. Any deviation from the standard UIC must be designated by another name and unique characteristics.

Faced with the formidable task of developing a data base strong enough to support CNOCOM/MIS, the members of the Data Base Subsystem Branch began their chore.

Utility of Data

The tools available to the team, whose project it was to construct the CNOCOM/MIS data base, consisted of the results of the previous studies and the survey discussed in the background contained in Chapter II. The primary objective of the survey held in 1969 was to determine what information systems were in existence within OPNAV; second, to determine if the systems were fulfilling the needs of their sponsors; third, to evaluate the validity of need for the data being generated; and fourth to determine what additional data were required by the sponsors that were not being furnished by the existing systems.

Although the intent of this survey was not to identify and analyze each data element being used by the many sponsors, the results pointed out that the information

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[illegible]

[illegible]

[illegible]

[illegible]

could be categorized by sponsor, since each sponsor required a degree of unique data. It was recognized by the data base designers/analysts[1] that there was a considerable degree of commonality between users but the survey was not sufficiently definitive to indicate accurate percentages of such "cross-organizational-lines" data. This is still an unknown factor. However, as the files are actually constructed the file levels technique to be employed will cause the appropriate links to be made between the files. As a result of having the sponsor update his own data, associated files will also be updated. Therefore, while it is necessary to recognize the existence of commonality, it will be self adjusting in relation to its accessibility and maintenance.

By investigating the results of the survey (Appendices B, C, and D) and conducting more exhaustive interviews regarding file details with the OP code personnel, the Data Base Subsystem team was able to determine that approximately 75 percent of the information requirements critical to the performance of the OPNAV mission are currently contained within the existing systems. Having made this discovery, it was necessary to decide whether to use this data or begin

[1]Interview with Sarah Pillar, op. cit.

anew in the task of data base construction. While there is agreement that a gradual conversion to an MIS is necessary, there is not always agreement as to whether the new implementation should use the existing historical data files. Robert V. Head, has addressed this problem. He refers to the alternative approaches as "transitional" and "apocalyptic." He goes on to explain his terms as follows:

> Advocates of the transitional approach argue that, since an MIS is largely parasitic anyway, it is only logical to try to interface it with existing files and systems. They argue further that the typical company has an erroneous investment . . . in these systems, and that this investment must be protected and written off over as long a period as possible.
>
> Partisans of the apocalyptic philosophy base their arguments largely on indictment of the efficiency and adequacy of existing systems, asserting that it is better to start anew than to pour good money after bad attempting to perpetuate "second generation" system concepts into third or perhaps fourth generation management information systems.[1]

The decision reached by the team was to use what seemed to be the best of each approach to develop the base. By design, CNOCOM/MIS was never intended to be merely a parasite but to be a dynamic system which would make the data integrated into the data base work for the system. In this respect the decision could be seen as having "apocalyptic" tendencies. However, the designers felt

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[1]Robert V. Head, "The Elusive MIS," Datamation, Vol. 16, No. 10, September 1, 1970, pp. 25-26.

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that it was more economical to salvage as much existing data as possible without approaching the threshold of "pouring good money after bad." This measure of utilizing existing data files could be considered the transitional part of the decision.

Data Sponsors Assigned

After reviewing the OPNAV requirements, the Data Base personnel determined that each OP-Code would be designated as the Data Sponsor for all the information contained in its existing system files. As Data Sponsor each OP-Code was instructed to analyze the specific data elements in each separate system in relation to the current requirements of that office. This analysis, which is presently being accomplished, will produce levels of information grouped into data element families known as data sets. The major classification of each family unit will be distinct from the others. The sub-levels of information within each family will describe specific aspects of that information family. While each family unit will exist independently within its own boundaries, the units may be associated with each other to describe a larger universe of which they are all members. A more detailed analysis at the sponsor level will then scrutinize the synonymous data elements to determine if standardization exists or

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is feasible. Element name, field size and field configuration (i.e., alphabetic, numeric, special character or combinations with regard to character position) are those factors which must be in complete agreement with the parent data element before the data element being compared may be called a synonym will be allowed to remain in the data base. It will be so identified by means of the Data Base Dictionary which will link synonyms to a common definition. However, if the synonymous title is not needed for clarity it will be replaced with the standard title by the Data Sponsor.

Such a review and analysis will be conducted by Data Sponsors until each data element is massaged and purified. Each new element will then be manually annotated on a form and keypunched into a standard interim format to be used for loading the data base.

Data Directory and Dictionary

The interim format will be used since, by design, no data shall at anytime be incorporated directly into the data base. It must first withstand the rigors of stringent machine validation. Following this validation, each element will be subjected to an automated Data Translation in order to perform a Data Dictionary review, as indicated earlier, to determine commonality between requirements of different Data Sponsors, or of those elements overlooked by an

individual Sponsor while performing his edit. If found to be a synonym with an existing data element, its name will be recorded in the dictionary with other information pertinent to that data element. The new synonym will then be recorded in the Data Directory as a sub-element of the parent data element. It is this file which will contain the address of that data in the CNOCOM/MIS data base. When data is updated and the Data Dictionary indicates that there are applicable synonyms, the Data Directory review will further identify the additional records and files which must also be updated. Likewise, this same kind of chaining is accomplished each time a query is received so that all existing data available in the data base may be reviewed for possible extraction to satisfy the user's requirements. It is an extremely important facet in the design of the system since all information cannot reside in the computer memory simultaneously for manipulation.

Functional Structure

While studying the multitude of requirements placed on the system by OPNAV users, and the classes of data needed to respond to each user's need, it became apparent to the data base designers[1] that a functional division of information seemed most feasible. The functions selected were ships,

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[1]Interview with Sarah Pillar, op. cit.

aircraft and facilities since these seemed to include all facets of the Naval establishment. By this functional segregation it was possible to have the same group of data sponsors responsible for an entire function. This also facilitated initial data base construction since the sponsors existing files were generally built around these functional areas.

Within each function will be the data necessary to define and/or describe that functional area. That information will primarily consist of data sets, or units of the overall function (i. e., a ship, an aircraft, a facility would each be one data set within the specific functional area). Each data set is then described by the elements which make it up along with information about it. Some of these subsets include the static identification features, planning milestones, movement activities, manpower, materials required for its support and other pertinent information categories. This blending of information pertaining to the lowest element of a functional area into a record/data set which will completely describe that unit is the objective of integration. It is difficult to achieve and, although viewed by many as the epitomy of a management information system, it is necessary to, first, determine if such a data base is feasible and, second, weigh the benefits

generated by such integration in relation to the cost to attain it.

Cost-benefit analysis was done by the team constructing the data base and it was decided that the best flexibility could be realized by formulating two files for each data set (both of which will reside in direct access memory).[1] Since top management rarely queries a file to retrieve data pertaining to a single unit (data set) a determination was made that such information would be maintained in a Unit Information Module (UIM) file which is immediately accessible to but not a part of the Integrated Data Base (IDB). This file will provide the organizational definition of the unit; the component parts of that unit; and, it will maintain associations allowing units to be grouped during retrieval through use of the File Structure Module. The Unit Information Module will interface with the Directory in order to perform IDB accessing in either direction.

The IDB will contain organizational type of information pertaining to each unit. Such information would include (using a ship as an example) the fleet to which assigned, geographic location, scheduled deployments, readiness indicator, funding command, type commander, flotilla,

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[1] _Ibid_.

squadron, home port, etc. The UIM file will include: Ship class, current status code, days in status, acceptance data, contract number, personnel strength, pertinent ship characteristics, etc. There is a definite reason for splitting the information in this way. The UIM file will include all data pertinent to the unit as an entity in itself while the IDB will contain information which focuses on that unit's relationship to the overall Navy structure. While the IDB updating will most likely originate with top management, the UIM file information will be channeled up from lower and middle managers for updating.

The two files will be securely linked by an Internal Organization Structure Code (IOSC). (See Appendix F) Each unit regardless of file, will be identified by this code. Likewise, all queries will bear an IOSC configured the same as the unit's IOSC for immediate accessing to the unit data. The query IOSC, however, will differ from the unit IOSC's in that only those characters designating levels of information pertinent to the desired response need be coded in the qurey IOSC. The others will be left blank. For example, if the query demanded information pertinent to ships and aircraft under a certain Type Commander's cognizance, then the lowest level indicator in that IOSC would be Type Commander and all units under his responsibility would be

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included in the response. If, on the other hand, a query was made concerning the personnel strength of a specific aircraft carrier, then the query IOSC would specify the code for that ship.

When the UIM file is queried for unit data, certain extended information will be retrieved from association tables by means of an Association Table Reference number (ATR) contained in the UIM file and identifying the specific table. The reason for this method is to abbreviate the record size as much as possible while maintaining adequate linking capability. This also provides additional flexibility since voluminous tables may be added outside the UIM or IDB while only adding a single ATR to the unit's records.

In addition to providing the capability of linking the IDB to the UIM file by unit (ship, aircraft or facility) and the UIM file to the tables associated with specific units, it will also be possible to correlate the data between the functional areas for updating and retrieval.

Updating Files

The Data Sponsors will be responsible for the maintenance of data within their cognizance. This will be no burden for those elements which they maintain for their own use. However, they will be responsible for certain data

which is required primarily by other users. It is very possible that these elements may be overlooked. For this reason, data will fall into three basic categories regarding maintenance:

(1) Those elements which may lie dormant for extended periods but which must be readily available for manipulation.

(2) Those elements which must be updated periodically merely due to their dynamic nature.

(3) Those elements which will require updating if a related element is changed.

It is apparent that the first class of data will be updated as required. In order to ensure appropriate and timely maintenance of the second class, the Data Dictionary will contain an indicator designating each dynamic element as well as an update code. On a monthly basis the Dictionary will be scanned to determine if there are any of these elements which have not been updated in the time period indicated by the code. All such elements will be flagged and the Data Sponsors notified of the condition. The third class of data will be called "trigger elements."[1] These will be coded in the Dictionary so that any change in a related element, either by direct input updating or by a

[1] U. S. Department of the Navy, NAVCOSSACT Document No. 88S911 FD-01, DATAMAN III, 18 December 1970. (Draft) (Use of this Document authorized by Captain W. B. Anderson, Head, CNOCOM/MIS Branch, OPNAV on 21 January 1971).

computational updating, will cause the associated data element to be updated also. The update value of the "trigger" element may not necessarily be the same value as the element being directly affected, but the value will be changed as necessary to maintain the desired relationship between the two elements. The "trigger" element could be viewed as a reactive element.

COMMENTS

It should be apparent from the narrative pertaining to the nonfunctional subsystems that the intent of CNOCOM/MIS is to create a system of interrelated modules controlled by the basic design principles in order to be responsive to CNO's total requirements or those segments which make it up.

In addition, the description of the data base construction being held within the constraints of the above principles, should point out the extensive measures being taken to keep the design modular to the lowest level. (i.e., each element accessible through the Data Directory and Dictionary Module). D. C. Foster, (Code 10), NAVCOSSACT expressed the need for modularity and the resulting flexibility when he said.

> This is the thing that spawned the concept of CNOCOM/MIS . . . , CNO is a single organization when viewed from one perspective and a complex of organizations when

> viewed from other perspectives. Therefore, what we want to do is come up with a system that will serve the single organization in the one sense, and the various components of this complex or network of organizations in another sense. If you want to serve the complex organization, it means that there is a common intersection somewhere regarding the data elements in the data base in their relavancy to the various components.[1]

This type of system necessitates interface requirements far beyond the feasible capabilities of second generation system. Furthermore, even third generation executive software systems are not capable of interfacing files and hardware in the magnitude required. Existing compilers cannot support the system fully, but complemented by a data management system file manipulation can be accomplished efficiently and effectively.

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[1]Interview of D. C. Foster, (Code 10), U. S. Naval Systems Support Activity, Washington, D. C. on January 21, 1971.

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CHAPTER IV

THE SYSTEM RESPONDS

FUNCTIONAL SUBSYSTEMS

To this point, the discussion has been primarily concerned with the basics of CNOCOM/MIS, i.e., the tools which will manipulate the system. The tools described have been the six non-functional subsystems, which are subservient to the user's wishes, and the data base which is at the user's command. The system as described to this point could be compared to an automobile production line fully manned, having all of the parts available, but not producing output until it is given specific directions as to which style should be built. When a valid order is received by the line controlling device, the line and materials begin to react in a coordinated fashion until the completed car is assembled. Likewise, CNOCOM/MIS with its utility subsystems and data base is primed and ready to receive a command to accomplish some work. In this case, however, the command will be received from one or more of a series of functional subsystems.

Unlike the foregoing subsystems, these are the operational user-interface principles for the entire CNOCOM/MIS

System. All OPNAV requirements, indicated by the previously mentioned survey, will be satisfied by these subsystems and their modules. In addition to the non-functional subsystems already described, analysis and consolidation of OPNAV requirements resulted in a projected need for six more distinct subsystems as follows: Executive, Planning, Command, Management, Staff Services, and Programming/Budgeting/Resource Control. Commander Q. B. Morrison, Head, Systems Design Section, OPNAV said,

> The twelve subsystems are necessary in order to enable us to break the large "monster" down so that incremental assignments can be given to people to work on without getting them bogged down in the details of the whole complex system . . . . Without such an approach the sheer weight of the system would scare "hell" out of the people involved.[1]

This chapter will contain a brief description of the functional subsystems, their modules and associated files, followed by an overview of the intended operation of all of the subsystems. The discussion will then turn to the factors involved in querying user requests relevent to their assigned priorities, anticipated hardware extensions and anticipated software enhancements.

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[1]Interview with Commander Quinn B. Morrison, SC, USN, Head, Systems Design Section (OP-912D) on October 15, 1970.

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[1] [illegible]

Executive Subsystem

This subsystem is a body of principles and actions directed toward providing the CNO, VCNO and Operating Deputies (OPDEPS) with summarized information according to their needs. It is expected to function as the primary source of management intelligence for this level. While there will be needs for summarized reports, most of the CNO's requirements will be on an "as required" basis to be eventually replaced or supplemented by a near real-time exception reporting capability. In addition to providing a central information source for top management (CNO, VCNO, OPNAV), it will provide an integrated picture of CNO responsibilities, adequate display facilities, and the ability to highlight problems inconsistent with the existing objectives, plans and goals. By analyzing information pertinent to the request and providing aids to determine alternative solution paths, it will establish an environment for decision-making.

The Executive Subsystem consists of three modules: Objectives and Plans Module; Project/Program Status Module; and Problem Reporting Module. (See Figure IV-1)

Objectives and plans module. This module will provide the executive level with the capability of measuring technical progress in research and advanced development areas and of evaluating plans and objectives in relation to the overall goals.

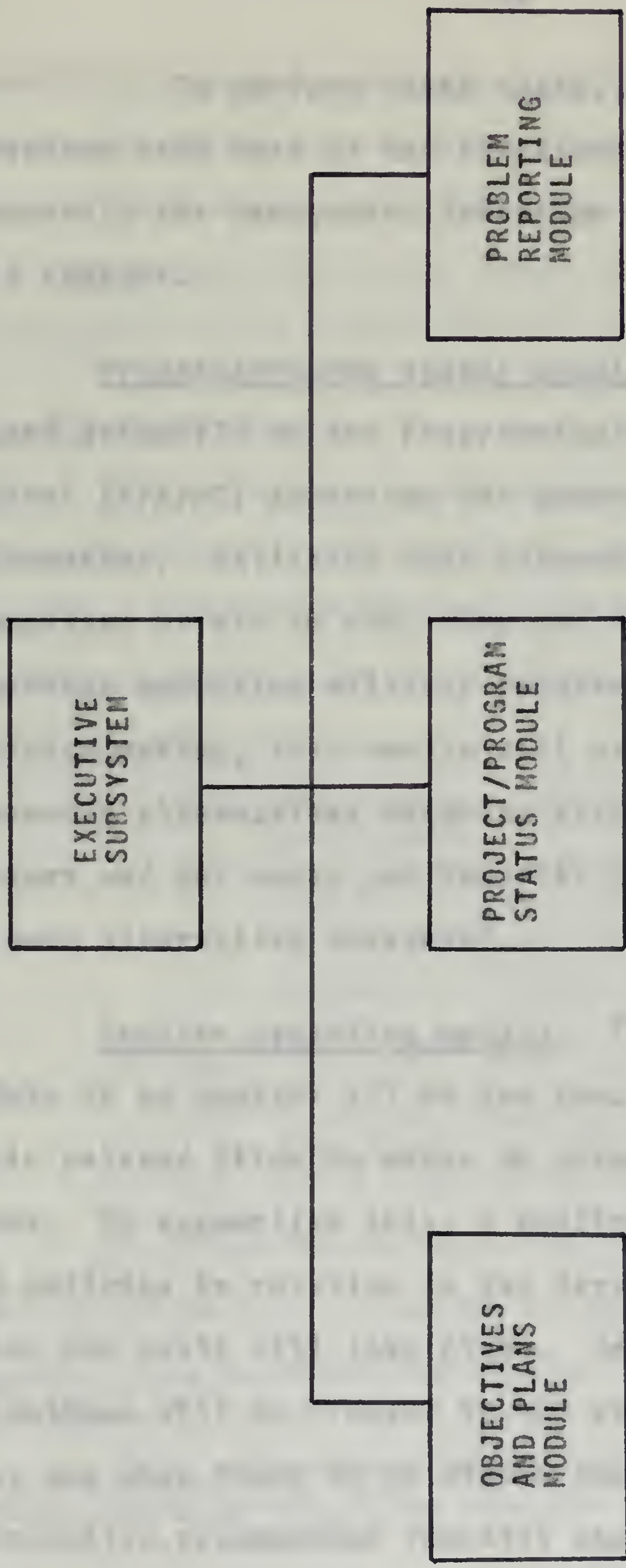
EXECUTIVE SUBSYSTEM
PROBLEM REPORTING MODULE
PROJECT/PROGRAM STATUS MODULE
OBJECTIVES AND PLANS MODULE

FIGURE IV-1

To perform these tasks, this module will interface with most of the functional subsystems, but especially the Management Subsystem described later in this chapter.

Project/program status module. This module will depend primarily on the Programming/Budgeting/Resource Control (P/B/RC) Subsystem for generation of required information. Utilizing that information it will provide summarized briefs to CNO, VCNO and OPDEPS for decisions regarding competing military programs. To aid in the decision making, this module will provide an analysis of trade-off alternatives weighing existing environmental factors and the costs and benefits that will be encountered by each alternative presented.

Problem reporting module. The intent of this module is to monitor all of the functional subsystems and their related files in order to detect emerging problem areas. To accomplish this, a continuing comparison of plans and policies in relation to the Navy's overall objectives, plans and goals will take place. Deviations from the overall guidelines will be brought to the attention of top management and when found to be within the system's capability, alternative recommended remedial courses of action will also be projected. When the system software does not hold the

capability to construct and prescribe the recommended courses of action, the module will cause all of the facts to be collected and evaluated. The resulting display in this situation would be the facts considered pertinent to an analysis of the problem by the manager involved.

Planning Subsystem

This subsystem is designed to provide the OPNAV users with the information required for Joint Forces and/or Navy Planning. CNOCOM/MIS planning information is intended to support the OPNAV users in decision making concerning the following activities:

(1) Navy input to joint strategic plans and studies.
(2) Navy strategic plans and studies.
(3) Review of joint papers for strategic planning and policy implications.
(4) Strategic guidance for research development, test, and evaluation needs.
(5) Reviews of general and contingency war plans.
(6) Strategic planning guidance for the information of Navy force levels.
(7) Joint operations planning and support.[1]

The Planning Subsystem is composed of four modules: Strategic Planning, Operation Planning; Operations Support Planning, and Modeling and Gaming. (See Figure IV-2)

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[1]U. S. Department of the Navy, CNOCOM/MIS System Design Proposal, op. cit., pp. 38, 40.

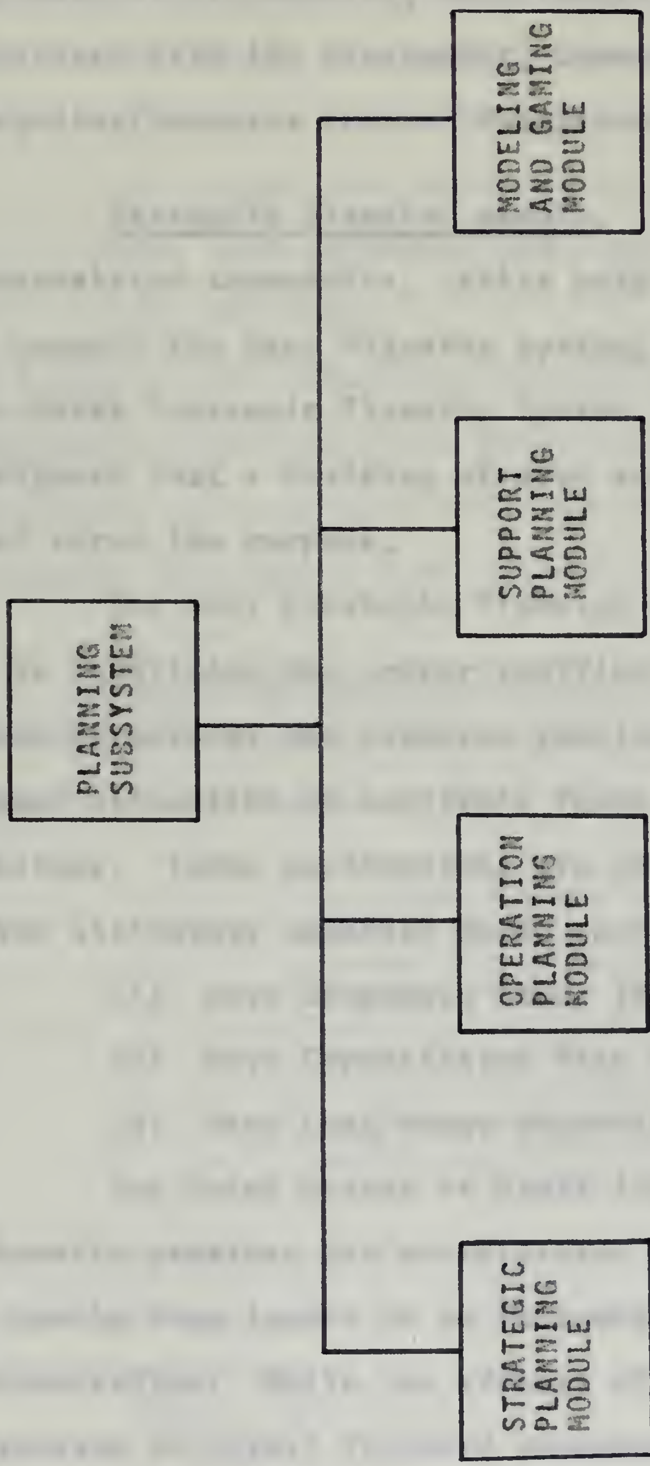
MODELING
AND GAMING
MODULE
SUPPORT
PLANNING
MODULE
PLANNING
SUBSYSTEM
OPERATION
PLANNING
MODULE
STRATEGIC
PLANNING
MODULE

FIGURE IV-2

By means of its modules, this subsystem provides information interface with the Management, Command, and Programming/ Budgeting/Resource Control Subsystems.

<u>Strategic planning module</u>. This module includes two interrelated submodules. While both submodules are structured to support the Navy Planning System, which in turn supports the Joint Strategic Planning System, it was felt by CNOCOM/MIS designers that a division of Navy and Joint information would best serve the purpose.

The Navy Strategic Planning Support Submodule objective is to facilitate the proper staffing and backup of the Navy force structures and resource requirements resulting in the proper allocation of available funds to meet prescribed missions. Three applications are contained in this submodule which ultimately generate three specific planning documents;

(1) Navy Strategic Study (NSS).

(2) Navy Capabilities Plan (NCP).

(3) Navy Long Range Objective Plan (NLROP).

The Joint Chiefs of Staff (JCS) Planning Support Submodule provides the coordination and finalization necessary to enable Navy inputs to be included in subsequent joint documentation. While the efforts of this submodule will not culminate in actual finished documents, it will prepare all of the Navy information required (except intelligence or logistics)

for inclusion in the following five document types.

(1) Joint Strategic Operating Plan (JSOP)

(2) Joint Strategic Capability Plan (JSCP)

(3) Joint Long Range Strategic Studies

(4) Joint Research and Development Objectives Document

(5) JCS Papers

This module will interface with various other subsystems of CNOCOM/MIS (functional and non-functional) in order to assimilate all available information into the integrated responses required by CNO, JCS, SECDEF and the President.

Operation planning module. The objectives of this module are to provide the procedures and ADP support to accomplish the following four tasks:

(1) Assist in more effective review of operational plans submitted by the JCS;
(2) Provide effective and efficient procedures for forwarding operational planning reports to the JCS;
(3) Establish more orderly methods of identifying, reporting, and processing force and resource shortfalls identified during the operational planning process, and
(4) Provide operation planning information required by other subsystems and modules.[1]

In order to perform these tasks, the Operation Planning Module has been divided into two submodules, Plan Review and

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[1] Ibid., pp. 73-74.

Joint Reporting Structual. Through the use of a number of separate applications the Plan Review Submodule will assist the OPNAV planner in evaluating the position and capabilities of the Navy with regard to meeting specified operating plans (OPLAN). It will compare the current assets contained in the Integrated Data Base (IDB) with the requirements needed to accomplish the OPLAN and identify shortfalls of manpower and material. Alternative resolutions will be generated including movement requirements and the scheduling of such movements. Finally, the Plan Review Submodule will coordinate all of the foregoing types of processes and compile the official Navy review of the Commander in Chief (CINC) initiated OPLAN.

The Joint Reporting Structual Submodule is designed to provide the current reporting requirements for the National Command Authorities and all DOD agencies which directly support military operations. It will be responsible for the following: identifying these requirements and preparing a catalog containing the name of each report, a description of the report format, punch card formats, magentic tape label formats, and transaction codes. This catalog must be periodically updated by a joint group.

<u>Operations support planning module</u>. Since the logistics aspect was excluded from the Operation Planning Module, this module will provide the supply and logistics

planners in OPNAV with improved capabilities for determining their requirements for both operation and contingency plans. The module has been further divided into five submodules which are: Planning Reference Data; Material Support Planning; Transportation Planning; Facilities Planning; Navy Support Plan.

The Planning Reference Data Submodule will create an automated file of selected portions of logistical reference manuals and ships characteristics data which will be readily accessible on-line when an OPLAN is received for review and analysis. Much of the data for this file will be obtained from the various Naval Systems Commands. Where necessary to construct loading plans and the like, information will be received from the other services, JCS and DOD.

The Material Support Planning Submodule will aid logistics support planning in the area of material analysis. When evaluating a contingency plan, it will generate estimates of supply requirements. This information along with data concerning production lead times and stockpiling sites will be invaluable to the OPNAV planners.

The Transportation Planning Submodule will also support logistics support planning. When confronted with a contingency plan, this submodule will generate the estimated requirements for the mobile logistics support force ships, the pipeline shipping requirements, and port throughputs for all suppliers utilized by deployed Naval combat units.

Such information will assist planners in the overall supply distribution plan including positioning of reserve stocks and port workloads. If the contingency plan is found infeasible owing to the inability to satisfy the requirements, the information formulated by this submodule will assist in the planners' modifications.

The Facilities Planning Submodule will assemble and coordinate all information pertaining to Navy shore facilities. It will be able to provide the capabilities (excluding air) for all such facilities. This information will fall into the categories of port loading rates, storage capacities, berthing, etc. The indication of shortfalls in these areas will point out where the needs for military construction are most predominant.

The Navy Support Plan (NSP) Submodule will contain the principles and procedures to develop and maintain a file containing the projected force structures based on the currently approved NSP/JSOP forces.

<u>Modeling and gaming module</u>. This module will support the entire Planning Subsystem by providing computerized multi-level simulation techniques. The simulation will include either Navy or Joint Forces, and the tactics will encompass military situations ranging from unilateral and/or logistic operations to multi-sided nuclear strategy in a

general war environment. The data file will be constructed in a modular fashion. The purpose of this design is to permit modular interchangeability to create a more realistic environment during simulation.

The Modeling and Gaming Module consists of four submodules, which are: Strategic Gaming; Contingency Gaming; Tactical Simulation; and Logistics Simulation.

The Strategic Gaming Submodule, utilizing five separate applications will develop, document, maintain and utilize the gaming models and parametric data for two-sided general war situations in support of OPNAV requirements.

The Contingency Gaming Submodule will utilize two applications to develop document, maintain and implement its models and parameters for gaming two-sided contingency or limited war situations.

The Tactical and Logistics Submodules will generate the basic models to be evaluated by an incorporated into the broader Strategic and Contingency Submodules.

Command Subsystem

This subsystem will support the CNO in the exercise of his command responsibilities over the operating forces. Decisions derived by this subsystem are not product-oriented as in the case of a document generated to predetermined specifications and format such as a budget. It is actually

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a byproduct of the decisions previously made in other subsystems and modules. The output can be viewed as a resumé of decisions to date, the degree of compatibility of these decisions toward attainment of the CNO's goals, and a pointer to deviations which could be potential weaknesses. It will assimilate three types of information: Operations, readiness and intelligence. By the same token, there are three modules to accomplish these undertakings: Operations, Readiness Analysis, and Intelligence. (See Figure IV-3)

Operations module. Information necessary to provide CNO and OPNAV with current and projected operational status is contained in this module. The data will include movements, employments, casualties and the overall readiness of afloat units as determined from Operations Orders (OP-orders), planning documents, briefings, etc.

The output will be in the format desired by the requestor in addition to the regular reports generated.

There will be a need for historical, current and projected data in the files. Here as in other modules and functional subsystems, a high degree of file interface is necessary. This will be required not only to update the ranging files, but also to formulate trends and decision aids for presentation to the CNO and his staff. In addition to preparing standard reports, a number of submodules and specific applications will provide the capability of

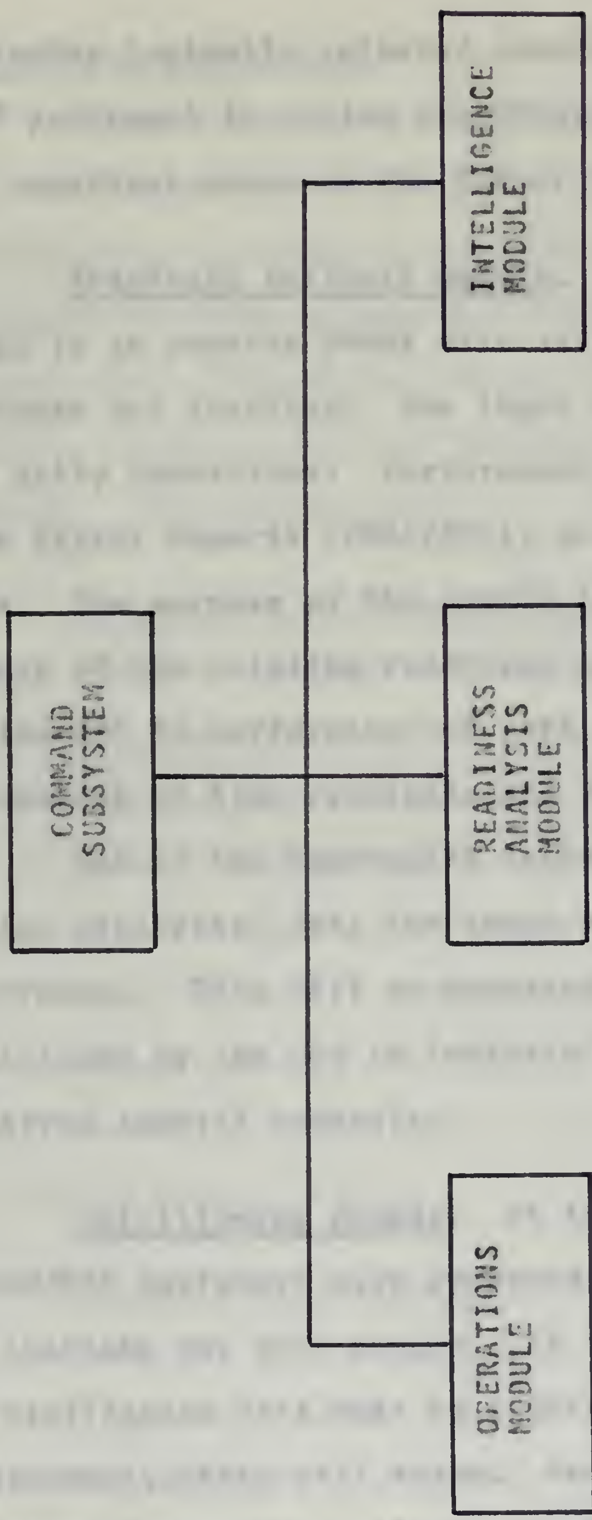
COMMAND SUBSYSTEM
INTELLIGENCE MODULE
READINESS ANALYSIS MODULE
OPERATIONS MODULE

FIGURE IV-3

displaying logically selected excerpts from the files to aid staff personnel in making briefings or responding to "what if?" questions posed by the CNO or higher echelons.

Readiness analysis module. The objective of this module is to provide OPNAV with all data related to fleet readiness and training. The input to the data base will be from daily Operational Performance Data Reports (OPDATS) and Force Status Reports (FORSTATS), prepared by all operating units. The purpose of the module is to present an overall picture of the existing readiness and training condition to aid the CNO in performance of part of his mission, (i.e., maintenance of high readiness and training standards).

One of the submodules included in this module will use the historical data for trend plotting and analysis of performance. This will be compared to the standards established by the CNO to indicate areas of weakness requiring special emphasis.

Intellignece module. At the present time, the CNOCOM/MIS designers have proposed no firm submodules or applications for this module. It is not yet clear what type of intelligence data must be provided and the security requirements which will ensue. However, it is a certainty that such information will be required for various decision processes. The sources will be both Naval and external.

Staff Services Subsystem

The services provided by this module consist of both manual and automated methods. It is designed to provide administrative services to the OPNAV staff for the normal day-to-day business operation. It consists of four modules: Administrative Information Control and Retrieval; Common Services; Automated Message Processing; and OPNAV Internal Services. (See Figure IV-4)

Administrative information control and retrieval module. This is designed to increase the efficiency and effectiveness of mail and directive distribution and routing. It places emphasis on reduction of duplication of both effort and material. Included herein are such features as control and registry of incoming and outgoing pertinent correspondence; a rapid retrieval capability for all controlled correspondence; and an assistance service to ensure OPNAV directives have been prepared in the correct format and coordinated appropriately.

Common services module. This module will provide support services that cross functional lines. These services will include, but are not limited to, the following: A reference system which will make needed documents available to the users; and, an automated correspondence service. The latter service will attempt to eliminate duplicate

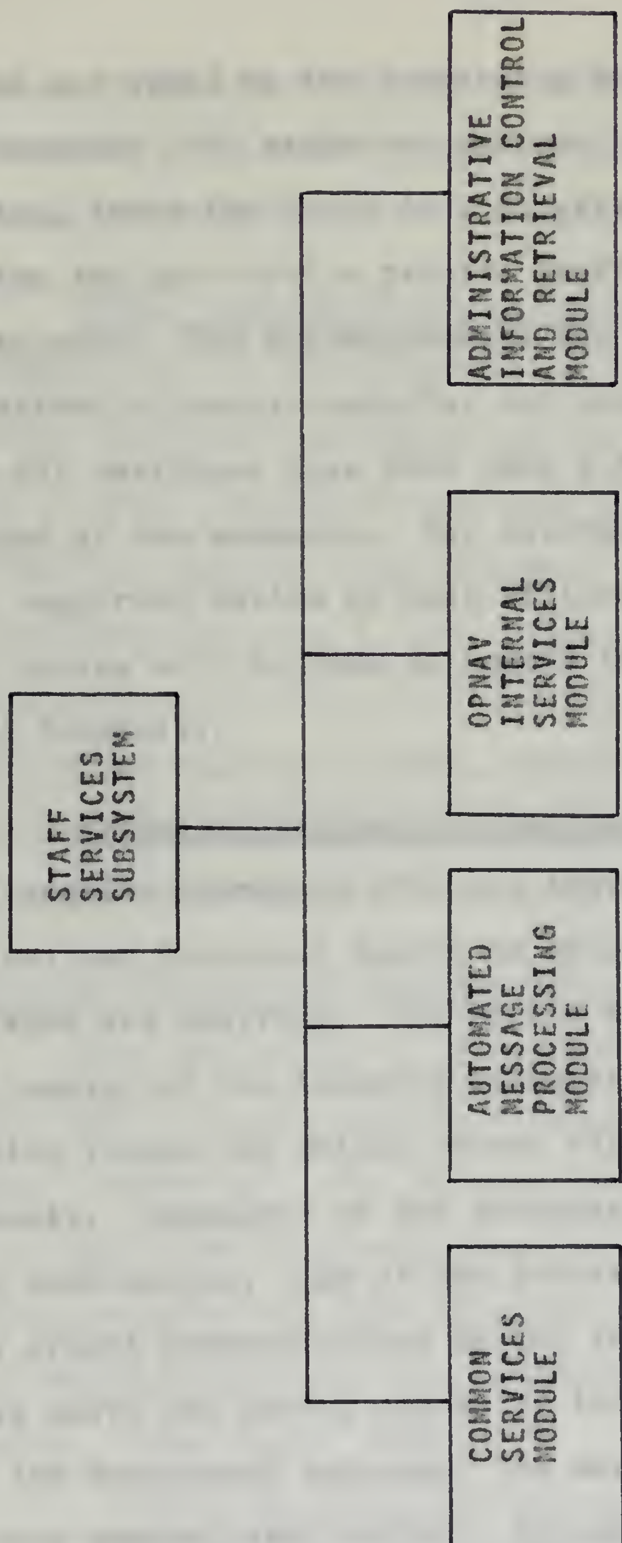
STAFF SERVICES SUBSYSTEM
ADMINISTRATIVE INFORMATION CONTROL AND RETRIEVAL MODULE
OPNAV INTERNAL SERVICES MODULE
AUTOMATED MESSAGE PROCESSING MODULE
COMMON SERVICES MODULE

FIGURE IV-4

typing and speed up the processing of outgoing correspondence. The computer will accept an unformatted draft, perform minor editing, store the draft in a computer storage area and provide the user with a printed draft in a format selected by the user. The correspondence can then be revised as much as desired by merely entering the changes into the computer. When all revisions have been made a final copy will be printed by the computer. For extremely critical correspondence requiring review by many offices, it is planned that this review will be done on remote Cathode Ray Tube (CRT) Terminals.

<u>Automated message processing module</u>. This module will require interface with the Administrative Information Control and Retrieval Module to determine message routing patterns and controls. The module will be responsible for receipt of the incoming messages, conversion into routing format and making proper distribution of the contents. Dependent on the precedence/security classification combination, some of the addresses will receive the most urgent communications by CRT terminals. However, for those users not having access to the remote terminals, or for low precedence messages, the module will direct attention to copy control and routing. In addition, since messages requiring replies have specific timeframes within which the

response should be released, an automated service will be provided to alert the holder of his unfulfilled obligation to avoid unnecessary system "sluggishness."

OPNAV internal services module. Owing to the past constant state of flux regarding organization, office spaces, security clearance and other general administrative items it is a requirement that such information should be filed to avoid unnecessary duplication of effort and inexcusable errors resulting from a lack of coordination. Some of these classes of information are: Organizational data, position descriptions related to jobs, security requirements and clearance lists, office space assignments, and telephone assignment controls.

Programming/Budgeting/Resource Control Subsystem

This subsystem is an extremely important segment of CNOCOM/MIS. It will contain financial and economic information required in order to make projections concerning every fact of Naval operations. It contains three basic modules to carry out this extensive mission, which are: Navy Model; Data Evaluation and Analysis; and Resource Control. (See Figure IV-5)

> The objectives of the Programming/Budgeting/ Resource Control (P/B/RC) Subsystem are to provide the tools to produce processed information that will assist the staff of the Chief of Naval Operations (OPNAV) to formulate Navy force objectives;

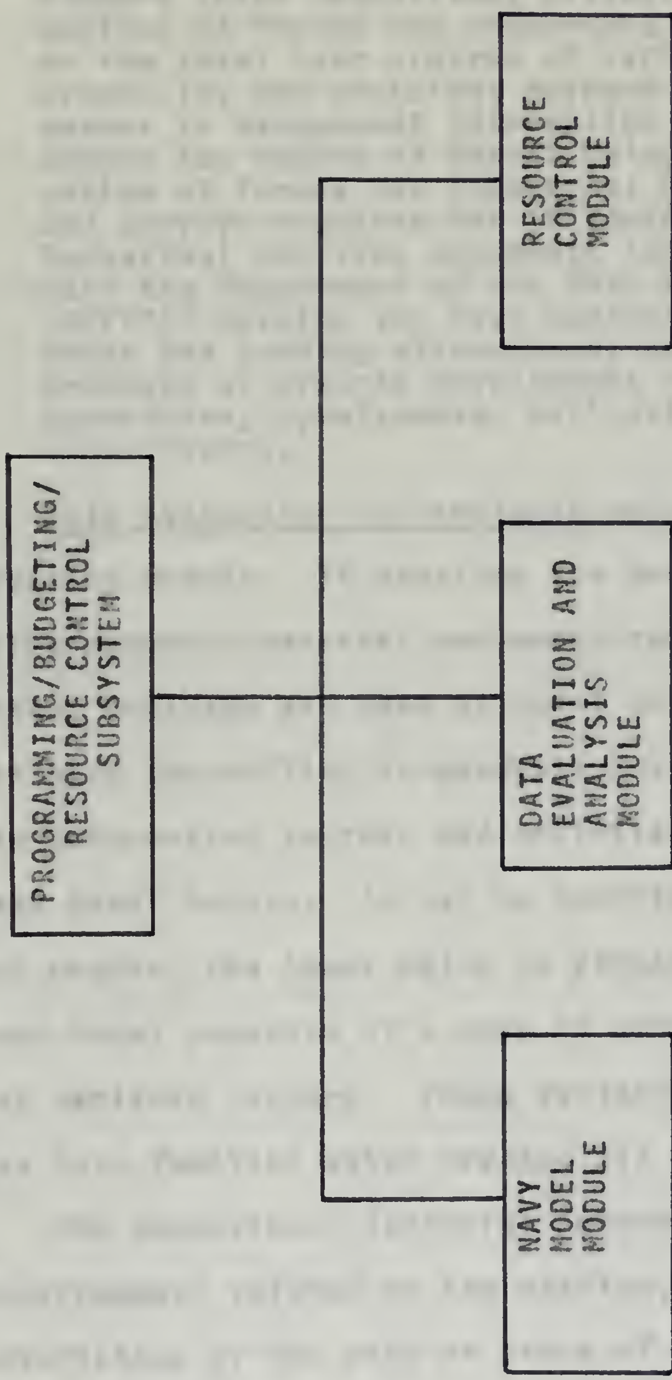
PROGRAMMING/BUDGETING/
RESOURCE CONTROL
SUBSYSTEM
RESOURCE
CONTROL
MODULE
DATA
EVALUATION AND
ANALYSIS
MODULE
NAVY
MODEL
MODULE

FIGURE IV-5

> determine and identify the resources required to support these objectives; evaluate alternative choices of forces and resources; evaluate impact on the total Navy program of various guidance proposals, and decision; respond in a timely manner to management information requirements; assess the degree of threat being satisfied by a choice of forces and resources; prepare, review, and approve required PPB (Planning Programming Budgeting) decision documents and reports; maintain the Department of the Navy Five-Year Program (DNFYP); develop the Navy budget; prepare apportionments and funding allocations; and review the progress of program development by monitoring operations, commitments, obligations and expenditures.[1]

Data evaluation and analysis module (DEAM). This is a supporting module. It provides the means whereby data regarding manpower material and money can be collected, validated, analyzed and used as input to the IDB. It will further have the ability to generate quantifiable data from certain information sources and assimilate it for use by the Navy Model Module. As may be surmised from the name of that module, the input which is prepared by DEAM for the Navy Model consists of a maze of economic and inventory control variable factors. These variables have been grouped into families which created six submodules.

The Operational Variables Submodule will describe the requirements related to the mission, the operating characteristics of the unit or piece of equipment and the tempo of operation.

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[1] Ibid., p. 40.

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The Inventory Variables Submodule refers to the quantities of material and manpower in use, and a projection of anticipated loss of men by attrition and various other factors regarding both men and material.

The Procurement Variables Submodule pertains to the abtainment of facilities, items of material or manpower through purchase, construction, modification or (in the case of manpower) through training.

The Industrial Variables Submodule describes the capabilities of the national economy, the industrial complex, and the labor force required to enhance the force structure in support of the procurement of materials or manpower.

The Support Variables Submodule refers to items of direct and indirect support required to maintain the force.

The Cost Variables Submodules identifies cost relating to the items of information or factors included in the other family groups of the preceding variables.

It had been anticipated by the data base designers that the data required by the foregoing submodules would be held in the IDB. However, it now seems that the information to be accumulated will be extremely massive.[1] A more feasible way will be to store most of the information outside of the IDB in association tables readily accessible

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[1]Interviews with Sarah Pillar, op. cit. and D. C. Foster, op. cit.

by use of linkages provided in the unit information records and the tables. The linking will be coordinated by the Data Directory and Dictionary Module File. This is entirely dependent upon availability of adequate file manipulation software.

Navy model module. The intent of this module is to provide a means to accumulate aggregate data pertaining to the total structure of the Navy. Such information would include factors and algorithms which may be drawn upon to compute quantified responses to questions derived by the CNO, OPNAV or higher level external requestors such as JCS, SECNAV or SECDEF.

Some of the capabilities provided by the Navy Model Module will be: A single source of information for all factors pertaining to the previously cited P/B/RC objectives; ability to manipulate algorithms and equations related to given sets of factors for the purpose of attaining "optimization"; a means of evaluating situations and displaying risks in quantifiable terms; the ability to automatically update constant factors when analysis of historical data finds it necessary; and the ability to measure program progress in terms of time and milestones.

In the past, the CNO and the Navy Comptroller (NAVCOMPT) have been noticeably slow in responding to queries

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concerning budget or program matters which have been received from SECNAV, SECDEF of Congress.[1] In the future, the Navy Model Module will provide the means to compile responses to these "what if?" type of questions in a matter of minutes.

<u>Resource control module</u>. While the DEAM collected, validated, analyzed, and stored the data needed by this subsystem and the Navy Model Module manipulated the data and factors to derive a response, this module will primarily act to support those modules. This support will include such tasks as creation of a central file for approved planning and cost factors used by the subsystem, and providing information for timely responses to cyclical requirements placed on the P/B/RC Subsystem.

Management Subsystem

The Management Subsystem will provide information to the CNO and OPNAV to support the multitude of programs with which the Navy is involved. It will perform various analyses such as program requirements determination and asset status maintenance. It will interface with every subsystem in CNOCOM/MIS and possibly every module. Data will be provided to the Command, Planning and P/B/RC Subsystems by

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[1]Interview with Captain Jack Cockrell, U. S. Navy, Head, Program Budgeting Review Branch (OP-904), Washington, D. C. on November 13, 1970.

this subsystem. In addition, it will utilize the other subsystems to extract, evaluate, analyze and display information pertinent to any selected module employed by the Management Subsystem.

Similar to the P/B/RC Subsystem, the scope of this subsystem is divided by the Navy activities which it serves. Each of these functions have been identified as a module which follow: Ships, Aviation, Manpower, Support, Communications, Intelligence, Research and Development, Warfare, and Special Programs. (See Figure IV-6)

Ships module. Two submodules are contained within this module. The one covers the area of ships management while the other encompasses simulation models for various type of ship employment scheduling.

The Ships Management Submodule pertains to the status and inventory of ships, small boats and service crafts. It will handle information concerning construction programming and the execution of same, as well as the requirements for all of the vessels indicated above.

The Ships Simulation Submodule embodies the attack carrier (CVA) deployment scheduling model and the amphibious warfare operations analysis model. Both models are dependent upon variables supplied by the Naval Systems Commands. In

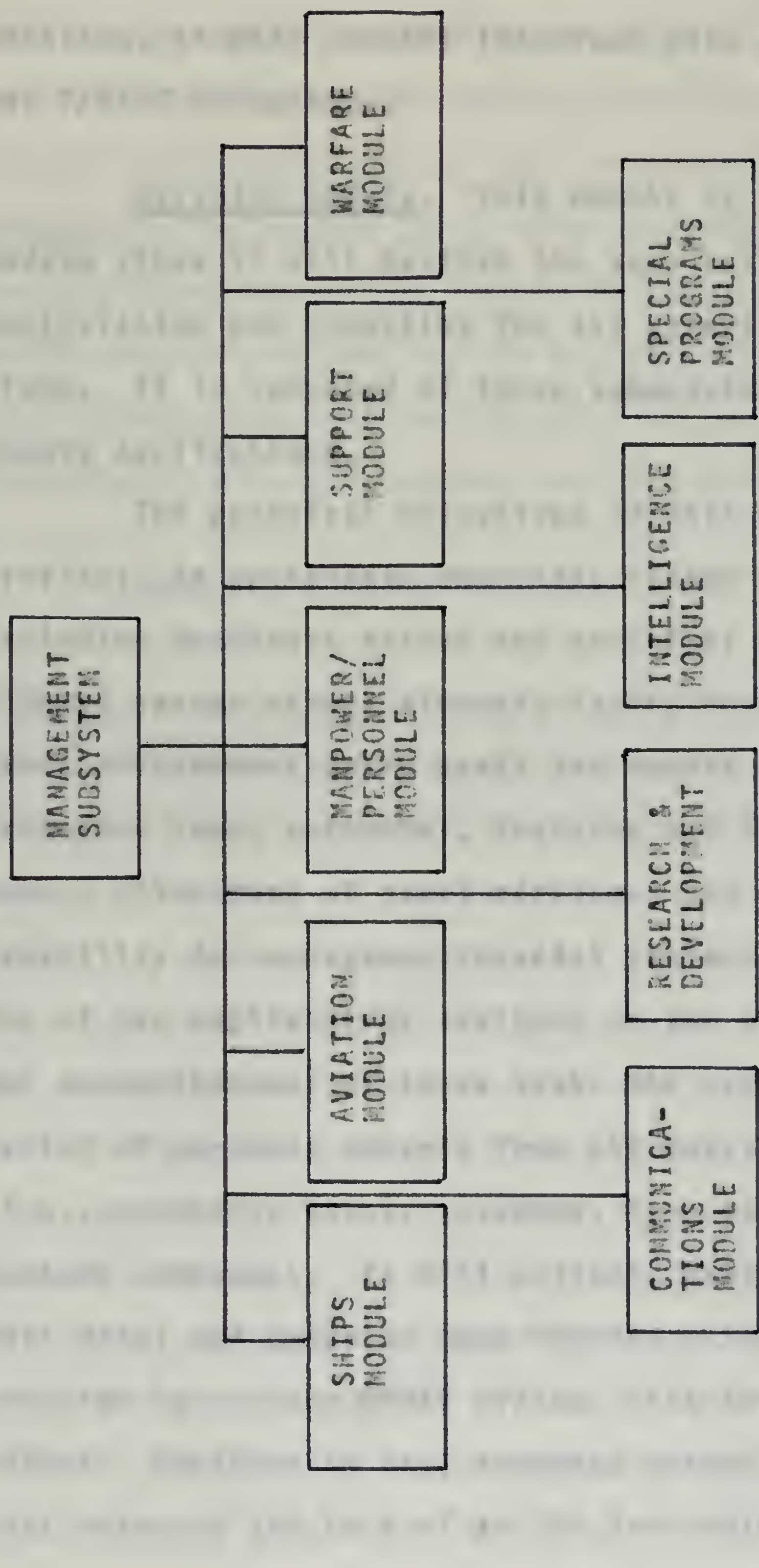
MANAGEMENT SUBSYSTEM
SHIPS MODULE
AVIATION MODULE
MANPOWER/ PERSONNEL MODULE
SUPPORT MODULE
WARFARE MODULE
COMMUNICA- TIONS MODULE
RESEARCH & DEVELOPMENT
INTELLIGENCE MODULE
SPECIAL PROGRAMS MODULE

FIGURE IV-6

addition, it will require interface with the Planning, Command and P/B/RC Subsystems.

<u>Aviation module</u>. This module is similar to the ships module since it will perform the same sort of data collection, manipulation and reporting for all aircraft and their functions. It is composed of three submodules and a total of twenty applications.

The principal objectives of this module are to provide: An up-to-date reporting system of all aircraft including readiness status and activity; a comparison of planned versus actual aircraft flying hours; projected aircraft procurement spare parts and rework requirements; projected base, personnel, training and facilities requirements; allocation of naval airspace; and analysis and gaming capability for management/special projects. These are but a few of the applications assigned to the Aviation Module. In the accomplishment of these tasks the system will receive a myriad of periodic reports from all levels of management (i.e., operating level, squadron, type commander, fleet and systems commands). It will collect, validate and analyze this data; and generate many reports which are now being prepared by various OPNAV offices with less than coordinated effort. Needless to say, accuracy currently suffers considerably owing to the lack of an IDB from which to draw information.

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The rapid technological advances in the field of aviation and the highly mobilized nature of the aircraft itself have caused much of the aforementioned query-response problem in the recent past. For that reason, one of the primary purposes of this module is to provide a feasible total aircraft program to the P/B/RC Subsystem. All pertinent information will be contained either in the IDB or the UIM which are readily linked for real-time operation.

Manpower/personnel module. The importance and potential of this module to assist the CNO in developing short and long range manpower requirements is overwhelming. As a module, it will interface with automated manpower systems already in existence. While manpower/personnel is not considered as one of the three functional areas in the IDB, it will cross each of these lines to update and interact with the total IDB. Unlike the present system where there are no aggregate figures readily available, both military and civilian personnel will be included in the new system. This should eliminate redundancy in accounting and maximize the utilization of personnel with similar training and experience levels. It is anticipated that future requirements may be projected as far as ten years, dependent upon the firm policy planning generated in the Planning Executive and P/B/RC Subsystems with which this module will

interface. Such a projection is contingent upon so many factors, including the technological improvements in weapons systems, the economy, etc., that it can be only a guess at this time.

Needless to say, the personnel records will be quite extensive for each individual. Historical files will also be maintained. Aside from the statistical value of this module, it will also be possible for the Office of the Chief of Naval Information (CHINFO) to request biographical sketches of personnel.

While there are six more modules in the Management Subsystem, as may be seen in Figure IV-6, it appears that the reader will be able to surmise, from the preceding descriptions of the Ships Module, Aviation Module and the Manpower/Personnel Module, the general plan of this subsystem. Therefore, only a synopsis of the remaining modules will be mentioned to emphasize the depth which has been designed into CNOCOM/MIS.

The Support Module contains information pertinent to all facilities, material and transportation. Material in this sense pertains primarily to petroleum, oil and lubricants (POL), conventional ordnance, and items specifically selected for review and analysis.

The Communications Module is concerned primarily with the problem of data exchange. There will be direct

interface with an existing system, Naval Communications Command/Management Information System (NAVCOMM/MIS), in the accomplishment of this module's mission.

The Intelligence Module will assist OPNAV in the development, coordination and promulgation of policies, plans and programs for the intelligence and security activities within the Navy.

There has been little effort expended on the Research and Development (R&D) Module at this time. This is due to the fact that the planners and designers readily recognize the wide range included in R&D but did not feel that this module could be adequately researched in the time allowed for the design of CNOCOM/MIS. A much broader investigation into the needs of R&D is planned for the future.

The Warfare Module will strive to develop techniques and procedures for both offensive and defensive forces. The forces include: Anti-submarine warfare (ASW), strategic missile and weapon systems, and submarine.

The Special Programs Module will direct attention to three unrelated but important areas. It contains a submodule for information concerning the Military Assistance Program (MAP); one for Offshore Activities, which will provide support for the establishment of ocean surveillance standards; one to provide guidance in the development of a

Navy-wide integrated automatic data processing (ADP) information system.

CNOCOM/MIS AS AN OPERATING SYSTEM

The entire CNOCOM/MIS concept has been laid out and the Subsystems with their respective modules have been briefly described. Although it is entirely feasible for the non-functional subsystems to operate as a separate entity independent of the functional subsystems it must also be realized that such a condition occurs only during file maintenance operations. Even in those operations there is a considerable amount of interdependency which exists between the various non-functional subsystems and the modules.

Storage Capability

A comparison of the CNOCOM/MIS objectives listed in Chapter II, and the objectives of the individual non-functional and functional subsystems, reveal that all objectives are in complete consonance.

There is one area of methodology that tends to detract from the original design. That is the concept of an integrated data base. The approach selected by the analysts, however, was one of optimization.[1] Since they

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[1]Interview with Sarah Pillar, op. cit.

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recognized that it would be infeasible, with respect to equipment cost, to construct one mammoth IDB, they chose the option of abbreviating the IDB and generating linkages (described in Chapter III) in order to retrieve any data held in any system file. Nothing has actually been lost by this concept. All information which may be needed in real-time will reside in separate files on direct access devices of varying access speeds. The storage device used is dependent upon the normal priority of the user. The IDB will reside on the smallest fixed-head drums since its content is to be retrievable at the highest rate of speed. The next level of data would be stored on the larger fixed-head drums followed by the next lower level on movable-head drums. The lowest level of data to receive direct access treatment will be stored on disc files.[1]

It should be readily apparent from a review of Appendix F that access time will be far from slow in CNOCOM/MIS since the discs are the slowest directly accessible devices used. However, in an effort to compensate for the need for levels of data accessibility the designers and analysts at NAVCOSSACT are reviewing a storage hierarchy plan introduced by the Rome Air

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[1]Interview with D. C. Foster, Head, Systems Design Branch (Code 10), U. S. Naval Command Systems Support Activity, Washington, D. C. on January 21, 1971.

Development Center, Rome, N. Y.[1] This system records the access frequency on each assessible element and automatically transfers the data from one storage device to another depending on the speed of access required for optimum effectiveness and efficiency. Such a system would readdress and move either data elements or whole strings of data automatically as required by the level of need.

Tape storage will be used for all historical files which are not required for real-time computations and/or analysis. In addition, some active files which are expected to be required periodically to interface with the IDB, but which are not required for real-time responses, will also be maintained on magnetic tape. An example of this latter type could be the variable used to represent the economy's industrial complex. This information may be updated weekly or monthly at which time the "trigger" elements previously described in Chapter III would cause other factors contained in the P/B/RC Subsystem to be updated.

System Use and Maintenance

The plan for construction of the IDB has been previously described. Assuming now, that the system is operational there are a number of principles which must be

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[1] Ibid.

established in order to perform perpetual file maintenance and to receive, process and respond to user requests.

Primary users of the system will be equipped with remote terminals which may be either CRT or teletypewriter, depending upon the type/size of display normally required and the anticipated rate of traffic through the terminal. File maintenance traffic, unless it is necessary for updating factors and data needed in real-time, will not be considered when projecting the terminals expected throughput. The reason for this is because many of the Data Sponsors who supply vast amounts of information to the IDB and peripheral files, do not require immediate response to their queries. The input and output needs of these users will be satisfied through the Customer Services Branch, (i.e., the Navy Information Center-NAVIC). There will be a U-9300 Remote Terminal located at NAVIC in addition to the existing computers which are: An IBM-7090, and IBM 1401, and IBM 1410, and an IBM-360/20. None of these computers will be devoted to CNOCOM/MIS applications but they will have the capability of interfacing with the U-1108 through the U9300 in order to perform specific functions for CNOCOM/MIS.

Since one of the foremost tasks of the designers, analysts and programmers of an information system is to maintain the integrity of the data base, CNOCOM/MIS will initially utilize the NAVIC Computers to perform a majority

of the validations before allowing any information which will alter the data base to gain access to the IDB and related files. This will also mean that input data which is initiated from a remote terminal in a high level staff office will first be subjected to validation on a NAVIC Computer before it is transmitted to the U-1108 for entry into the IDB complex. As the system emerges and settles down, the validation should be condensed requiring less computer time and the older IBM machines will be phased out. Queries on applications which do not update the files will not require such a rigid preview and will be permitted to access the U-1108 directly. At the present time, the exact quantity of remote terminals to be used is not known, but the designers of CNOCOM/MIS feel that about 15-18 such terminals may be feasibly serviced without increasing excessive system overhead.[1]

Priorities and Queueing

Jobs entering the management information system are temporarily placed in a job queue which will be controlled by the operating system. The queue will reside on one of the floating-head drums.

The software must efficiently place jobs in queue, scan and evaluate the jobs in queue, select jobs for

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[1] *Ibid.*

processing, and delete completed jobs from the queue. It will arrange the jobs in the order which they are to be completed dependent upon the assigned.

The operating system will ensure that low priorities are handled within the timeframe required. After a low priority job has been passed over a number of times, and the computer clock approaches the job's deadline time, the operating system will automatically raise the priority of the job to force it ahead of other pressing jobs. This eliminates the possibility of having a low priority job in queue for an unreasonable period of time. The ability of the operating system to supervise job queues determines the effectiveness of the system. The saturation point for job queueing is a function of the arrival rate, service time and priority of the jobs entering the queue. It is the task of the operational software to allocate available equipment time to jobs in order to optimize customer satisfaction.

The effective queueing of jobs depends on a well defined priority system. Some of the more sophisticated executive systems have priority routines containing up to 100 levels subsequently grouped into three or four categories. Norman Enger outlined what he considers to be a typical choice of job priorities[1] as follows:

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[1]Norman L. Enger, Putting MIS to Work, op. cit., p.85.

(1) Emergency priority--run immediately.

(2) Background priority--assigned to jobs that would use low speed peripheral devices at their maximum speed.

(3) Special priority--used for short jobs which may be interwoven with existing jobs.

(4) Input/output priority--assigned to jobs that will keep the I/O Channels fully occupied.

(5) Compute priority--used for jobs consisting of a significant amount of mathematical computation (process-bound).

Maximum use of peripherals produces system efficiency. Therefore, since computer power is abundant in relation to peripheral power, jobs with compute priority have the lowest priority.

In the U-1108 Executive System (EXEC-8) there will be three basic levels of priority: Real-time, demand, and batch.[1] Real-time will require servicing the program to get the results back to the source of inquiry in time to effect on going events. Demand priority exhibits a need to be processed in a relatively short timeframe. The deadline time assigned, or allowable wait time, in relation to the input time becomes extremely critical in this priority level.

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[1]Interview with D. C. Foster, op. cit.

A demand job in queue may only be preempted by a real-time job or another demand job having a shorter completing time-frame. The batch priority will be assigned to jobs requiring overnight service. These, too, will be assigned a deadline time and as that time draws near the priority will be raised to insure completion.

COMMENTS

Given a system consisting of the complex subsystems and the hardware configurations as discussed in the preceding chapters, the user is still confronted with the day-to-day task of man/machine interfacing.

The CNOCOM/MIS designers are currently attempting to provide a system which will require minimal data processing experience and knowledge. It is anticipated that the user will be able to query the IDB through a remote terminal using near English language statements. He will need to know only the English names of the data elements he wishes to retrieve. Further, if the user is not aware of what the IDB contains, the system will assist him by furnishing on the terminal what is available within the parameters established by the requestor himself.

The user must have the capability to both query and update files by either direct access dialogue or batch processing. This capability will in turn necessitate retrieval or updating of multiple files concurrently.

Reports are never useful and efficient unless they give the information required by the user in a format intelligible to him. CNOCOM/MIS would not be fulfilling this need if it could not provide a means of free form report generation which is able to select only that information desired by the user in his designated format.

Considering the advancements built into third-generation hardware and the design features of CNOCOM/MIS, it is not practical to contemplate the use of second generation compilers such as COBOL, FORTRAN or RPG for this level of file management.

CHAPTER V

SUMMARY

OBJECTIVES AND BENEFITS

The primary purpose of CNOCM/MIS is to improve the command/control and information handling capabilities of CNO and of the OPNAV staff through the use of advanced data processing equipment and techniques. CNOCOM/MIS will help provide the timely, high quality information needed to efficiently support the decision-making, planning, programming, budgeting, and coordinating functions in OPNAV. In general, it will assist Navy top management in: setting objectives, shaping and evaluating alternative strategies, making decisions and measuring results.

Common CNOCOM/MIS Benefits

With the attainment of the overall CNOCOM/MIS objectives listed in Chapter II, these anticipated common benefits will follow.

Accessibility of information. The users, OPNAV staff members, will be able to locate information readily for their decision-making. It will be provided by subordinate commands

CHAPTER I

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via communications links and stored on mass storage devices. The information will be presented to the user by means of remote display units or through the service center as appropriate.

Integration of information. Integrated information will eliminate duplicate reporting and conflicting data. It will permit use of a wider range of information to all users.

Reliability of information. The data sponsor system will lead to more timely and reliable information for all staff elements. Security and limited access protection of the data files will be maintained by design of the maintenance software.

Distribution of information. The flow and distribution of information into and out of OPNAV staff offices will be considerably improved. Reports currently received or transmitted by the staff will be consolidated, where possible, decreasing the overall flow.

Information storage and processing capability. CNOCOM/MIS will provide the automated capability to acquire, store and manipulate large quantities of data necessary for effective decision-making. Many applications will be processed concurrently causing more timely report generation.

Ease of user/system interface. The OPNAV staff, users will be able to communicate with the system and to use its capabilities fully with extensive ADP or information system training. Besides remote terminal accessing and manipulating, there will be the ability to pre-test the sensitivity of data and its effects on decisions prior to actual live processing. This will afford either model or variable adjustment, as required, before implementation.[1]

Specific CNOCOM/MIS Benefits

While the foregoing common benefits will be realized by all users of CNOCOM/MIS, there are a number of anticipated benefits unique to the various subsystems. These are foundations for the total system and worthy of reemphasis.

Decision-making process. The P/B/RC Subsystem is a pioneering effort to provide more adequate information for the planning, programming and budgeting (PPB) specialists.[2] The crux of PPB is the systematic evaluation of alternatives in the performance of cost-benefit analysis. This processing will involve: Identification of naval objectives; the derivation and identification of alternative courses of action;

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[1] U. S. Department of the Navy, CNOCOM/MIS System Design Proposal, op. cit., pp. 224-225.

[2] Interview with N. N. Schauer, Technical Assistant, CNO Information System Branch at the Pentagon, Washington, D. C. on January 20, 1971.

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the estimation of total costs of each alternative; and an estimation of expected results of each alternative.

The primary benefits to be achieved by implementing the Manpower/Personnel Module center around the availability of more timely and detailed information for decision-makers. The establishment of a comprehensive data base of manpower management and personnel administration information will provide a single source to a wide spectrum of staff users. In addition, it will for the first time contain integrated data pertaining to both civilian and military personnel in the Department of the Navy.

Data collection and use. The data base will not reside entirely in a single storage or processing device, but will be supported from several sites which are intertwined by data transmission links. Although physically decentralized, the strict principles of data base management prescribed for CNOCOM/MIS will be prescribed by the centralized system. This will result in:

(1) Economies in file maintenance.

(2) Standardization of data elements, records and files.

(3) Savings in the high cost of input preparation by decreasing the number of inputs and sharing common data among users.

(4) An improvement in information accuracy by operation of all users from a common data base.

Captain R. A. Jones, SC, USN, former head of the CNO Information Systems Branch, and architect of CNOCOM/MIS, made the following comment regarding the realization of the foregoing benefits:

> The plan for achieving CNOCOM/MIS objectives is evolutionary in concept. A minimum of three-to-five years is required for a Management Information System of this size to even begin to realize benefits of any magnitude. A well thought out and realistic management plan accompanied by perserverance of top management will soon show progress that will gain momentum as management acquires the experience and confidence necessary to use this new tool.[1]

MEANS TO ATTAIN OBJECTIVES

In order to reach the desired objectives of CNOCOM/MIS and to realize fully the anticipated benefits of the new system it is necessary to define predetermined milestones. These benchmarks have been discussed individually in the preceding chapters as principles and procedures inherent to the various subsystems. The following is a consolidated recapitulation of the overall system requirements determined, by the writer, to be of prime importance for objective attainment:

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[1] R. A. Jones, Captain, SC, USN, "CNO Command Management Information System," Navy Management Review, March-April 1970, p. 20.

(1) The construction of a data base capable of incorporating automated and non-automated information by means of a Data Directory and Dictionary technique.

(2) The ability to link the automated data files for retrieval and maintenance, and to provide a safeguard against possible breaks in the linkages.

(3) The ability to index selective fields for retrieval and to perform extensive validation of all data input to the data base.

(4) To provide the capability of total file maintenance from a limited number of data sponsor inputs (i.e., update all files affected by any single element change).

(5) To allow for the entry, recording, processing and extraction of variform data.

(6) To provide for an increased capability to interface CNOCOM/MIS with all of the existing software systems found to be basically compatible.

(7) To provide for operational interface among the various existing hardware configurations and anticipated reconfigurations.

(8) The development of a secure data communication network which will permit middle managers at the fleet level direct access to the data base.

(9) To permit OPNAV staff users, and eventually fleet users, to directly access the files by means of remote terminals and to manipulate data and/or extract it in the format desired.

(10) To design a software technique which will guard private information by allowing access only to those found to be qualified.

(11) Development of a priority and queueing system which will differentiate between real-time, demand and batch requirements while performing the jobs within the timeframe allowed by the requestors.

EXISTING CAPABILITIES

The U-1108 and its peripheral devices will provide up to nanosecond speed for accessing, processing and displaying information. The central processing unit (CPU) is designed to accomplish multi-programming which is the concurrent operation of many programs. The dual processor (two CPU's) feature used for CNOCOM/MIS further expands the capabilities to allow both CPU's to perform multi-programming simultaneously while sharing the same executive program.[1]

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[1]Interview with R. R. Whittington, UNIVA Consultant, Washington, D.C. on November 11, 1970.

The executive program (EXEC-8) requires one bank of CPU storage, or 55,000 words.[1] The dual processing environment thereby conserves an entire bank of storage which can be devoted to operational programming.

Modular software design working in conjunction with the multi-programming and multi-processing features mentioned above, makes it possible to utilize a feature known as reentrance. This is a technique by which multiple users employ common programs or subroutines in order to conserve CPU storage.[2] If a program is non-reentrant it is necessary to lay the entire program in core for processing which reduces available memory and the number of programs which may be serviced concurrently.

Even with the increased capabilities of the third generation hardware and its executive system there remains an unfulfilled need to manipulate files more efficiently. Each program must be written to perform its own file processing. Such duplication becomes extremely costly both at program generation time and at run time. The EXEC-8 was written to interface with COBOL. This compiler alone utilizes 40,000 words of core and still does not provide adequate file handling or system interfacing features. R. R. Whittington, UNIVAC Consultant, further claims that

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[1]Interview with D. C. Foster, op. cit.

[2]Interview with D. C. Foster, op. cit. and with R. R. Whittington, op. cit.

the computer industry as a whole oversold the higher level languages.[1] He feels that there are two main inefficiencies which were not adequately revealed to the businessmen: The use of a syntax requiring ADP orientation by the user and the extensive need for core in relation to the meager file handling capabilities to be realized.

While the compilers have provided ease in writing programs to personnel with minimal ADP training, there is still a need for at least that amount of basic training before man/machine dialogue is possible. Furthermore, the programmer must receive even more training if he is to profitably encounter a file-to-file interface. The computer software industry has acknowledged this problem and as a result the data management systems (DMS), sometimes referred to as file management systems (FMS), are now being perfected by numerous firms to fulfill this technological requirement.

A DMS/FMS OVERVIEW

Having realized the shortcomings of the third generation equipment, EXEC-8 and the existing compilers, NAVCOSSACT launched a comparative analysis of eighteen data management systems. The DMS's, previously cited in Chapter III, were initially evaluated against the following

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[1]Interview with R. R. Whittington, op. cit.

criteria by the study group. In addition to the hardware, executive and compilers, the group established these features as basic requirements for the accomplishment of CNOCOM/MIS objectives.

Mandatory Features

1. Direct access of fields used as retrieval/ update arguments.
2. Command macro languages for file description, maintenance and retrieval.
3. On-line/remote capabilities for retrieval and update.
4. Efficient use of immediate access devices for data base storage.
5. Standard system formatted outputs and user defined flexible report formats.
6. Implementation within a reasonable time at a reasonable cost.

Desirable Features

1. Multi-file capability for both maintenance and retrieval or its equivalent.
2. Hardware independent source language of implementation.
3. Capability of interfacing with POL and AL coded programs for sophistocated applications beyond the scope of the interval command languages.
4. Input data validation.
5. Data base integrity and access rights to the field level during simultaneous on-line/ batch processing.
6. Optional usage statistics to the field level.
7. Conversational language capability for all modules.
8. Capability to change the file description (without regenerating the entire field) and automatically maintaining the credibility of the data.[1]

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[1]U. S. Department of the Navy, A Study and Evaluation of Data Management Systems, op. cit., pp. 16-17.

Seven of the systems survived the initial evaluation and were then subjected to a more detailed analysis. The technique used for this phase was developed by Informatics, Incorporated for the Air Force in 1967.

Each of the DMS's were graded against 279 criteria which made up the following categories:

(1) file definition and structure

(2) file creation and maintenance

(3) query/extract

(4) access rights

(5) query output presentation

(6) extract output presentation

Appendix G[1] contains the rating results of each of the seven systems evaluated.

The study concluded that no existing DMS in its present state was capable of supporting the CNOCOM/MIS concept. The group determined, however, that it would be feasible to enhance an existing system to provide the desired level of support. The DMS selected, by the evaluation, was the Generalized Information Management System (GIM) developed by TRW Systems.

The recommendation was approved by CNO and NAVCOSSACT was directed to proceed. The new hybrid was named DATAMAN III

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[1] Ibid., p. 55.

and is now in the proposal stage to fulfill the following requirements:

a. Command macro languages for file description, maintenance and retrieval. English-like statements which facilitate use by personnel with varying levels of functional and data processing backgrounds.
b. Selective indexing capability, i.e. direct access of items used as retrieval/update criteria.
c. Effective capabilities for retrieval and update in both on-line and batch modes.
d. Standard system formatted outputs and user defined reports of highly sophistocated or complex structures.
e. Capability to maintain and/or retrieve from multiple files concurrently.
f. Validation of input data.
g. Capability for interfacing with programs coded in procedure oriented or machine oriented languages for computational functions beyond the scope of the command language.
h. Data base security and privacy provisions.
i. Conversational languages with tutorial aids.
j. Optional usage statistics to the item level.
k. Re-entrant processing.[1]

CONCLUSIONS

In view of the elaborate system design of CNOCOM/MIS requiring extensive files, modules, subsystems and systems interface as well as the near English language on-line query/processing capability, adoption of a data management system (DMS) is not only justified but is mandatory for system realization. Without the development and implementation

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[1]U. S. Department of the Navy, DATAMAN III, op. cit., pp. 4-5.

of a DMS to fulfill the specific requirements of CNOCOM/MIS it would be impossible to integrate twelve subsystems of the magnitude of those described in Chapters III and IV into an operational entity. With the dynamic combination of CNOCOM/MIS design, the U-1108 system with EXEC-8, existing compatible assemblers/compilers and DATAMAN III, the CNO and his staff will possess the highest level of data accessibility, processing and report generation attainable at this time.

However, considerable effort must be given to two weaknesses which will plague the system in the long range if not corrected. The first of these is the need for a secure data transmission media which can be used for classified, unclassified or varying degrees of privacy information concurrently. The second weakness is dependent upon successful accomplishment of the first. It is the need to provide the middle managers at the fleet headquarters level with direct access capability to the IDB at the earliest opportunity. Without a timely exchange of information with these commanders of the "seagoing Navy" CNO will never achieve the ultimate responsiveness desired but will ". . . pour good money after bad attempting to perpetuate 'second generation' system concepts into third or perhaps fourth generation management information systems."[1]

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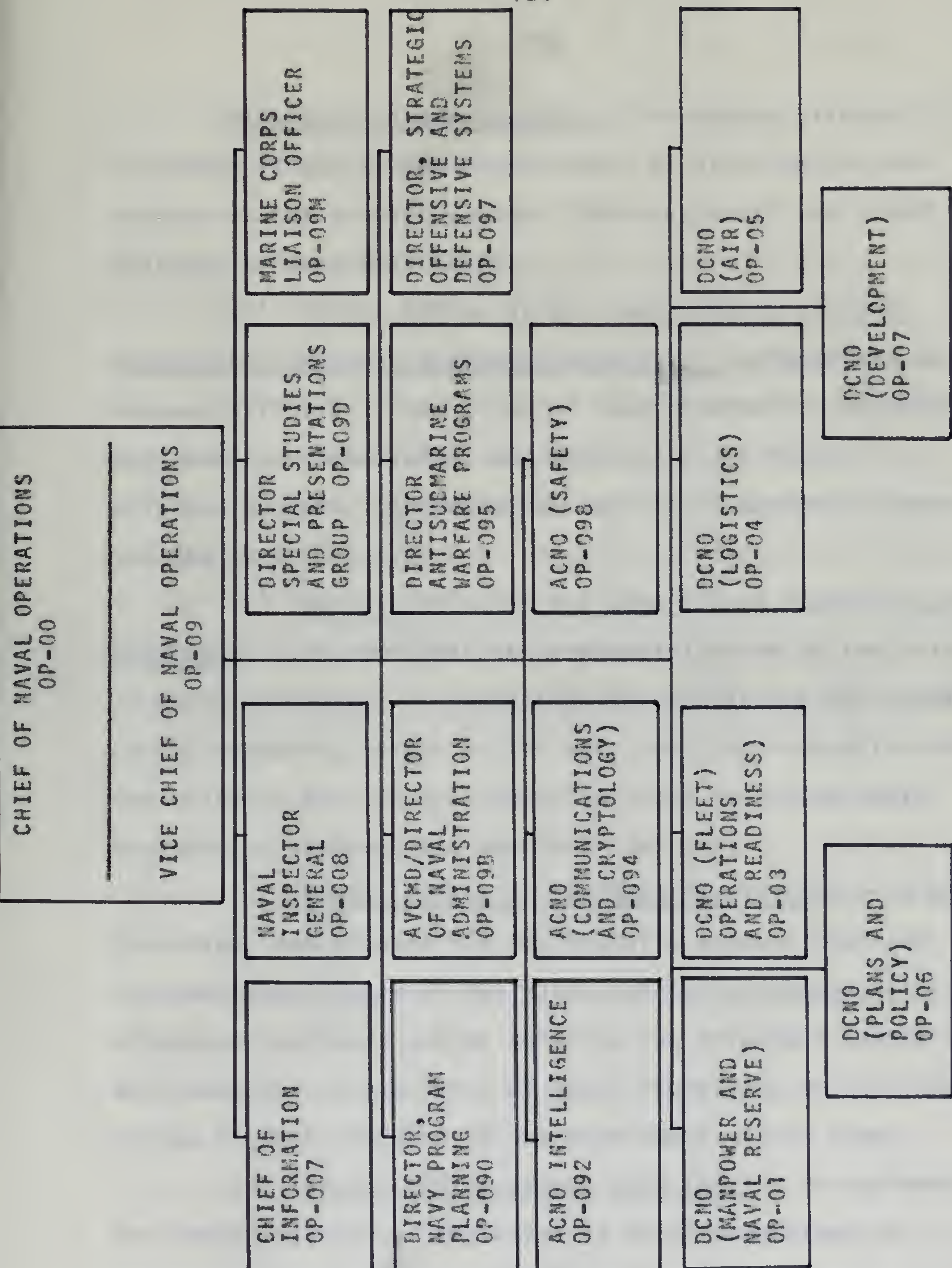
[1]Robert V. Head, "The Elusive MIS," op. cit., p. 26.


CHIEF OF NAVAL OPERATIONS
OP-00
VICE CHIEF OF NAVAL OPERATIONS
OP-09
CHIEF OF INFORMATION OP-007
NAVAL INSPECTOR GENERAL OP-008
DIRECTOR SPECIAL STUDIES AND PRESENTATIONS GROUP OP-09D
MARINE CORPS LIAISON OFFICER OP-09M
DIRECTOR, NAVY PROGRAM PLANNING OP-090
AVCNO/DIRECTOR OF NAVAL ADMINISTRATION OP-09B
DIRECTOR ANTISUBMARINE WARFARE PROGRAMS OP-095
DIRECTOR, STRATEGIC OFFENSIVE AND DEFENSIVE SYSTEMS OP-097
ACNO INTELLIGENCE OP-092
ACNO (COMMUNICATIONS AND CRYPTOLOGY) OP-094
ACNO (SAFETY) OP-098
DCNO (MANPOWER AND NAVAL RESERVE) OP-01
DCNO (FLEET) OPERATIONS AND READINESS) OP-03
DCNO (LOGISTICS) OP-04
DCNO (AIR) OP-05
DCNO (PLANS AND POLICY) OP-06
DCNO (DEVELOPMENT) OP-07

APPENDIX A

<u>Missions and organization</u>. The organizational structure of the Office of the Chief of Naval Operations appears on the preceding page. The mission of each OPNAV Division is described below:

(1) <u>OP-01, Office of the Deputy Chief of Naval Operations (Manpower and Naval Reserve)</u> - To implement the responsibilities of the Chief of Naval Operations for planning, programming, controlling, and appraising the Navy's military manpower, non-material aspects of manpower support and the Naval Reserve.

(b) <u>OP-03, Office of the DCNO (Fleet Operations and Readiness)</u> - To implement the responsibilities of the Chief of Naval Operations in respect to the operations and readiness of the Operating Forces of the Navy, with the exception of the Military Sea Transportation Service, including their employment, training and readiness for war.

(c) <u>OP-04, Office of the DCNO (Logistics)</u> - To plan, determine, and provide for the logistic support needs of the Operating Forces of the Navy, except for those areas elsewhere assigned, and to serve as the principal advisor and executive to the Chief of Naval Operations on the conduct of the logistic affairs of the Department of the Navy.

(d) <u>OP-05, Office of the DCNO (Air)</u> - To implement the responsibility of the Chief of Naval Operations in determining the requirements, force levels, and major [illegible]. [illegible]

(1) [illegible]

(2) [illegible]

(3) [illegible]

(4) [illegible]

characteristics in the execution of naval aviation programs, their planning, preparation and execution; to advise on naval aviation matters; and to represent CNO in naval air operations involving relations with other government and civil agencies.

(e) <u>OP-06, Office of the DCNO (Plans and Policy)</u> To develop and disseminate plans and policies, and serve as the principal advisor to the Chief of Naval Operations on Joint Chiefs of Staff matters and as the principal advisor to the Secretary of the Navy and the Chief of Naval Operations on international politico-military matters, including foreign military assistance.

(f) <u>OP-07, Office of the DCNO (Development)</u> - To implement the responsibilities of the Chief of Naval Operations and to assist the Assistant Secretary of the Navy (Research and Development) with respect to coordination, integration, and direction of the Navy Research Development, Test and Evaluation (RDT&E) Program.

(g) <u>OP-90, General Planning and Programming Division</u> Under the direction of the Director, Navy Program Planning, to develop and operate an integrated program planning system for the Chief of Naval Operations, assist in the formulation and administration of the operating budget, and implement the responsibilities of the Director, Navy Program Planning with regard to Navy programs and plans related thereto.

(h) <u>OP-91, Information Systems Division</u> - Under the direction of the Director, Navy Program Planning, to exercise centralized coordinating authority over information systems and exercise necessary direction and control of information systems development within Bureau, Offices, and Commands under the command of the Chief of Naval Operations in order to effect maximum practical integration and promote effectiveness and economy of ADP utilization; to plan, develop and implement and integrated command and management information system for the Chief of Naval Operations. Information systems as used herein apply to management and command and control applications.

(i) <u>OP-93, Long Range Objectives Group</u> - Under the direction of the Director, Navy Program Planning, to support the Chief of Naval Operations in his roles as principal naval advisor and as principal naval executive, with respect to the long-range objectives of the Navy, including those pertaining to the total strategic, tactical and technological future of seapower and other maritime-related matters involving the security and well-being of the United States.

(j) <u>OP-96, Director Systems Analysis Division</u> - Under the direction of the Director, Navy Program Planning, to provide the Chief of Naval Operations with a system analysis capability to evaluate the relative effectiveness of alternatives in program and program proposals and thereby to assist in the decision making process; to manage the CNO

Study Program and coordinate this program with other Navy Department study efforts; to review and evaluate study results; and to implement the responsibilities of the Director of Navy Program Planning for conducting scientific, analytical and technical studies through the medium of the Center for Naval Analyses.

(k) OP-092, Office of Naval Intelligence - To serve as the principal staff advisor to the Secretary of the Navy and to the Chief of Naval Operations on intelligence and security plans and policy matters; to implement the responsibilities of the Chief of Naval Operations to develop, coordinate and promulgate policies, plans, and programs for intelligence and security activities of the Department of the Navy; to represent the Department of the Navy on the United States Intelligence Board; and to advise and assist officials of the Department of the Navy in matters of protocol and liaison with foreign officials.

(l) OP-094, Office of Naval Communications - To exercise, as the communications executive to the Chief of Naval Operations, overall authority throughout the Department of the Navy, in matters pertaining to communications, cryptology, and the radio frequency spectrum; to determine, review, validate and approve requirements for the Department of the Navy in these areas.

(m) OP-095, Office of Antisubmarine Warfare Programs To exercise, for the Chief of Naval Operations, centralized

directive authority over all antisubmarine warfare planning, programming and appraising, in order to ensure an integrated and effective antisubmarine warfare effort; to implement the responsibility of the Chief of Naval Operations in all ASW matters pertaining to the determination of requirements, including development, the selection of work to be performed by the Chief of Naval Material, and the appraisal of work in progress for military worth and readiness; and to act for the Chief of Naval Operations in all matters affecting antisubmarine warfare.

(n) <u>OP-097, Strategic Offensive and Defensive Systems</u> - To exercise, under the Vice Chief of Naval Operations, as the strategic offensive and defense systems executive in the Office of the Chief of Naval Operations, centralized coordination over all strategic offensive and defensive force planning, programming, and appraising in order to ensure integrated and effective Navy strategic offensive and defensive applicable orders and directives, the responsibility of the Chief of Naval Operations in all strategic force matters pertaining to the determination of concepts, vulnerabilities, requirements, including development, and the appraisal for military effectiveness of work in progress.

(o) <u>OP-098, Office of the Assistant Chief of Naval Operations (Safety)</u> - To act for the Chief of Naval Operations

with respect to the direction and supervision of the planning and implementation of safety programs throughout the Department of the Navy (except for those areas wherein such safety responsibility rests with the Commandant of the Marine Corps); to act as principal advisor to the Chief of Naval Operations in all matters concerning safety.

(p) OP-09B, Assistant Vice Chief of Naval Operations/ Director of Naval Administration - To execute the administrative, management, and organization functions pertaining to shore-based activities and facilities to provide staff assistance to the Chief of Naval Operations; to provide required administrative support to OPNAV; and to serve as executive to the Chief of Naval Operations.

(q) OP-007, Chief of Information - Also as Staff Assistant to the Secretary of the Navy, advises the Secretary and Chief of Naval Operations on policies and methods relative to public affairs aspects of operations and activities. He coordinates Marine Corps public information matters with the Office of Information. He keeps the public informed on the activities of the Navy as an instrument of national security, and disseminates to naval personnel appropriate information on policies and programs of the Navy Department.

(r) OP-008, Office of the Naval Inspector General To inspect, investigate, or inquire into any and all matters of importance to the Department of the Navy, with particular

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[illegible]

[illegible]

[illegible]

emphasis on readiness, including but not limited to: Effectiveness, efficiency, and economy; personnel requirements, morale, welfare, and discipline; command relationships and organizational structure; management practices, including naval program development and control; and to serve as the principal advisor to the Secretary of the Navy and the Chief of Naval Operations on Department of the Navy inspection matters.

ADP SYSTEM NAME (EXISTENT/UNDER DEVELOPMENT)	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008		NAME
Mobilization Requirements Sys	S																			
Ships Planning System		S			C														XC	NDPIC, CNM, FLT COMDRS, FLD ACT
CNO Carrier Deploy. Sched. Sys		S																		
Flag Plot		S																	XC	JCS, FLEETS, NAV FACS, BUPERS
																			XU	SECNAV, VCNO, WWMCCS
Linear Regression Model			S																	
Jnt. East Asian Ammo. Proj. Sys			S																XC	NAVORD, SPCC, KEEBLE
ORD. Consumption Model			S																XC	SPCC, NAVORD, CINCPAC/LANT
POL Information System			S																XS	NFSO
Service Craft Acctg. System			S																	
Wang Elec. Calc. System			S																	
ARMACS System				S															XU	SAFETY CEN., COMNAVAIRLANT
Aircraft Invent. Audit System				S																
Aviation Information System				S																
Proj. Aviation Plans Summary				S															XU	NAVAL TRAINING DEVICE CENTER
AIS EAM System				S																
SIOP Processing System					S														XC	DEFENSE ATOMIC SUPPORT AGENCY
NEMO SIOP/RISOP War Game Maint.					S															

LEGEND	
C	Input Contributor
U	Output User
S	System Sponsor
X	External Activity

APPENDIX B

SYSTEM/ACTIVITY MATRIX (CURRENT SYSTEMS)

ADP SYSTEM NAME (EXISTENT/UNDER DEVELOPMENT)	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008		NAME
NEMO SIOP-4F/RISOP-69 War Game Support					S														XC	JWGA
																			XU	NMCSSC NWL
War Gaming					S															
Navy Prog. Eval. Procedure Sys							S												XC	NAVCOMPT
Point Papers System							S													
Congressional Inquiries System							S												U	Congress
NAVCOSSACT Mgmt. Info. System		U	U	U	U		U	U				U				U			XS	NAVCOSSACT
																			XU	CNO SECNAV, VCNO,
Navy Cost Information System	U	U	U	U	U		U	U			U	U				U			XS	NAVCOMPT
Radio Freq. Propagation Pred.												S							XC	ESSA
Navy Radio Freq. Mgmt Sys												S							XU	JMCEB, IRAC
OPNAV Pub. Invent. Sys																S			XU	CNO
MOVREP System	U	SU	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	XC	FLEETS
																			XU	FLEETS, ETC. JCS, DOD,
EMPSKD System		SU	U	U															XU	FLEET
SEA Operations Project	U	SU	U																XC	CINCs, JCS, FLEET, OPCON Cen.
																			XU	SECNAV Bureaus, CNO,

LEGEND	
C	Input Contributor
U	Output User
S	System Sponsor
X	External Activity

APPENDIX B

ADP SYSTEM NAME (EXISTENT/UNDER DEVELOPMENT)	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008		NAME
FER System		SU																	XC	Ships Via Fleet
																				Type, & Force Cmdrs
																			XU	Force Cmdrs Fleet, Type,
Navy Manpwr Information Sys	CU																		XS	BUPERS
Projected Manpwr Reqs Accts Sys	U																		XS	BUPERS
Projected Manpwr/Acct.Trng.Reqs	U																		XS	BUPERS
Navy Auto.Res.&.Dev.Info. Sys						U				U			U						XS	DDC
DON ADP Prog Reporting System								U											XS	SECNAV
Fleet ASW Data Anal. Prog. Sys													U						XS	NOL
ASW Simulation Models													U						XS	NOL
War Gaming Simulation Models					S															

LEGEND
C Input Contributor
U Output User
S System Sponsor
X External Activity

APPENDIX B

ADP SYSTEM NAME (UNDER DEVELOPMENT/PROPOSED)	OPNAV OP CODES 01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008	OTHER ACTIVITES	NAME
Navl Readiness Analysis System		S																		
Deploymt./Withdrwl.Planng.Rept.			S																	
Strat.SealiftConting.Plnng.Sys.																			XS	MSTS
JNT.Opns.Planng./ForcePkg.Rept			S																	
Ships Planning System (Revised)		U	S																	
Logistics Reference Data System			S																XC	JCS,CINCPAC, CINCLANT,CNO
Logistics Support Reqmts Sys			S																	
Avtn.Trng.Div.Mech. System	C			S															XC	BUPERS
OP-60 Strategic Studies Lib.Sys.					S															
Invent.ADP Applications/Progs.								U											XS	SECNAV
DON ADP Cost Reporting System								U											XS	SECNAV
DON ADP Program Reptng Sys								U											XS	SECNAV
Report Management System																S				
OPNAV Mail Handling System																S				
Auto.Manpwr./Org.Info.System	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	S	CU	CU	XCU	CNO,VCNO,DCNO
Telephone Publications System	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	CU	S	CU	CU	XU	DOD
CHINFO Personnel Information Sys																	S		XCU	CNO
																			XC	BUPERS

LEGEND	
C	Input Contributors
U	Output Users
S	System Sponsors
X	External Activity

APPENDIX C

SYSTEM/ACTIVITY MATRIX (FUTURE SYSTEMS)

ADP SYSTEM NAME (UNDER DEVELOPMENT/PROPOSED)	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	093	007	008		NAME
NEMOSIOP/RISOP Model Revision				S																
MAPMIS Activity System	S	C	C	C			C												XC	CHIEF NAVAL MATL SYS COMD
NAVINTCOM Mgmt. Info. System											S								XS	NAVINTCOM

LEGEND
C Input Contributor
U Output User
S System Sponsor
X External Activity

APPENDIX C

TYPE OF INFORMATION REQUIRED	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008		NAME-ACTIVITY/ SYSTEM/FILE
Civilian Manpower	F			R			R												XF	OCMM,BUPERS
Military Manpower	R																		XF	BUPERS
Contingency			R																XF	JCS(JOPS)SYS., MRES SYS.,TRASSYS
Nuclear Warfare					RU															
Plans and Policies					R															
War Gaming					RU															
Status				R						R									XF	NASC,NARF, MAINT. STATIONS
Force Level				R																
Reconnaissance		R																		
Foreign Disclosure		R																		
Research & Development		R				F													XF	DDC
Ship/Weapon		RF																	XF	NAVIAR,ENGIN-EERING CENTER
Management		R																	XF	NAVSHIPS
Operations/Performance		R																	XF	FLEET AND TYPE COMMANDERS
Training		R																	XF	CHIEF NAVL AIR, PACIFIC
ADP Management								R											XF	DON ADP Prog. Dept.Subsystems
ADP Project Status								R												
ADP Systems Exchange Library								R												

LEGEND	
R	Requestor of Information
F	Actual/Potential Source of Info.
X	External Sources of Info.
U	Unsatisfactory Info. Receipt

APPENDIX D

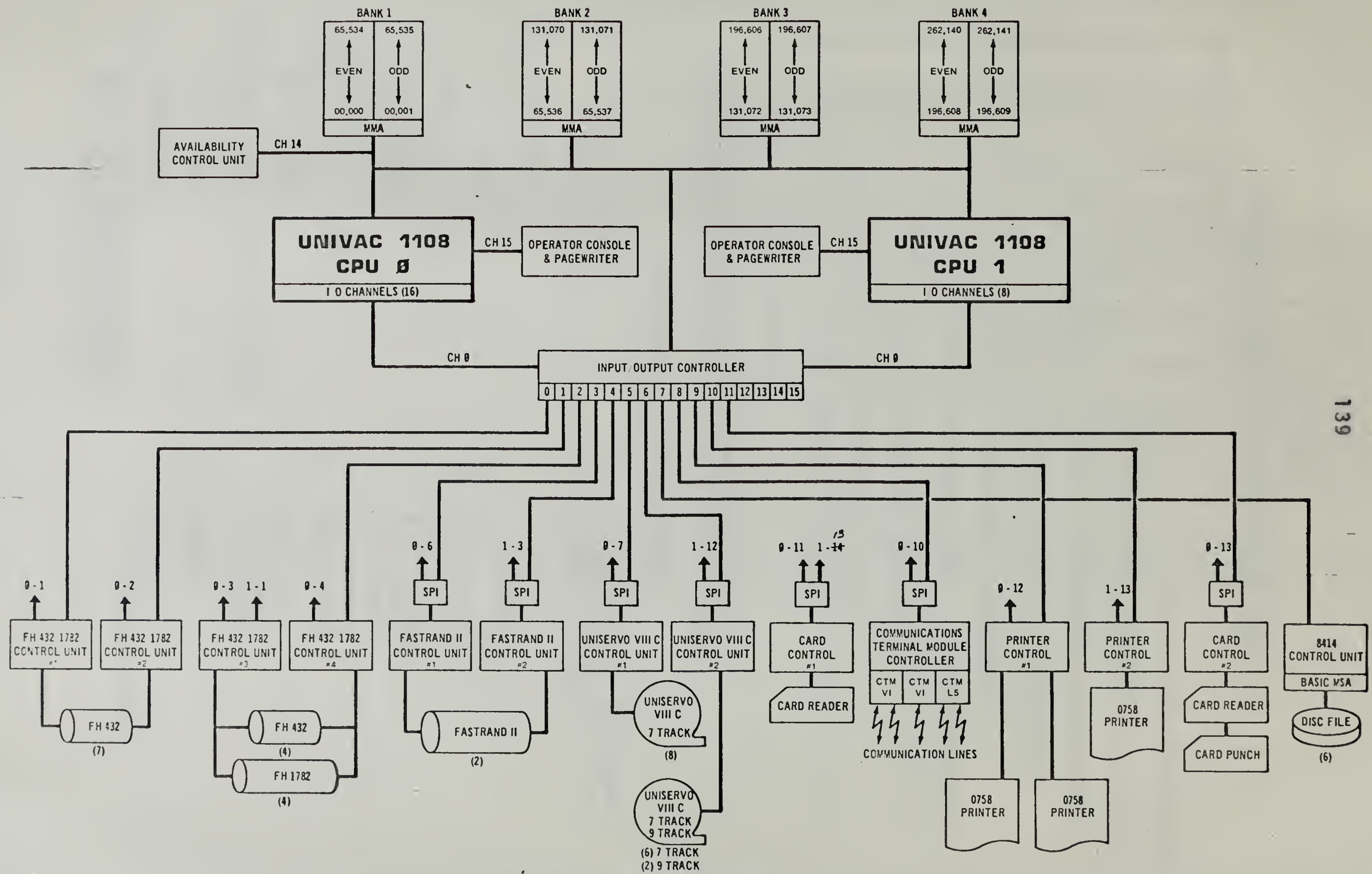
INFORMATION REQUIREMENT/ACTIVITY MATRIX

TYPE OF INFORMATION REQUIRED	OPNAV OP CODES																		OTHER ACTIVITIES	
	01	03	04	05	06	07	90	91	93	96	092	094	095	097	098	09B	007	008		NAME-ACTIVITY/ SYSTEM/FILE
Planning, Programming, Budget							RF			R									XF	NAVCOMPT, NAVPERS, NASC, NCIS SYS
																			XR	NDPIC
Budget		R	R					R		R									XF	PBAPRS SYS. FMSAEG, SASN
Budget Feedback							R												XF	OPERATING COMMANDS
Ships History				R																
Information Directory					R					R										
Communications												R								

LEGEND
R Requestor of Information
F Actual/Potential Source of Info.
X External Source of Info.
U Unsatisfactory Info. Receipt

APPENDIX D

NAVAL COMMAND SYSTEMS SUPPORT ACTIVITY



APPENDIX E

APPENDIX F

INTERNAL ORGANIZATION STRUCTURE CODE

W* XX** YY_1 YY_2 ZZ_1 ZZ_2 Z_3 ' A B ' K

- K → COST DESIGNATOR
- B → MATERIAL DESIGNATOR
- A → PERSONNEL DESIGNATOR
- Z_3 → BUREAU NO. DESIGNATOR
- ZZ_2 → SQUADRON DESIGNATOR
- ZZ_1 → A/C TYPE, MODEL, SERIES DESIGNATOR
- YY_2 → SHIP HULL NO. DESIGNATOR
- YY_1 → SHIP TYPE/CLASS DESIGNATOR
- XX → FACILITIES, (HOME PORT'ETC.)
- W → MAJOR CLAIMANT

* 1 character allows 34 possible combinations
** 2 characters allow 1156 possible combinations

Examples of IOSC Elements

W (Major Claimant)

1 - CINCLANTFLT

XX (Facility)

Ø1 - Norfolk

YY_1 (Ship Type/Class)

Ø1 - DD265
ØC - CVA65

YY_2 (Ship Hull No.)

Ø1 - DD265

ZZ_1 (A/C Type, Model, Series)

Ø1 - A-4A

ZZ_2 (Squadron)

Ø1 - 1st Squadron Assgd.
Ø2 - 2nd Squadron Assgd.

Z_3 (Bureau No.) (Assigned sequentially w/in Type, Model, Series)

1 - $nnnn_1$
$nnnn_2$

A (Personnel)

Ø - Officer
1 - Enlisted
3 - Other

B (Material)

Ø - N/A
1 - Nuclear
2 - Other

C (Cost)

Ø - N/A
1 - Cost Indicator

APPENDIX G

DATA MANAGEMENT SYSTEMS

SUMMARY OF OBJECTIVE EVALUATION

	COGENT	DM-1	GIN	IDS	IMS	RAPID	TDMS
File Definition and Structure	26.4	32.2	47.7*	14.3	9.3	21.9	26.8
File Creation and Maintenance	14.4*	13.4	11.3	5.4	6.2	7.3	10.6
Query/Extract	9.1	10.5*	7.9	2.6	1.3	6.3	9.3
Access Rights	9.0*	8.4	9.0*	2.7	4.6	7.9	3.2
Query Output Presentation	1.2	1.8*	1.2	0	0	1.4	1.2
Extract Output Presentation	6.2	5.5	6.5*	.4	.4	4.0	4.7
TOTALS	66.3	71.8	83.6*	25.4	21.8	48.8	55.8

*Denotes highest in category

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